

**Enclosure 1:**

**Annual Radioactive Effluent Release Report - 2010**



# **SAN ONOFRE NUCLEAR GENERATING STATION**

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## **Annual Radioactive Effluent Release Report**

**2010**

**January - December**

## **PREFACE**

San Onofre Nuclear Generating Station is located next to San Onofre State Beach, adjoining Camp Pendleton Marine Corps Base, in San Diego County, 64 miles south of Los Angeles, California. There are two operating pressurized water reactors with a total rated capacity of 2254 net megawatts electrical.

Unit 1, rated at 410 net megawatts electrical, was supplied by Westinghouse Electric Company and began commercial operation on January 1, 1968. The unit was permanently shutdown on November 30, 1992. By August 31, 2004, all fuel was transferred to the Independent Spent Fuel Storage Installation (ISFSI). As of November 29, 2006, all remaining monitored effluent pathways were permanently removed from service. Unit 1 is owned by Southern California Edison (80%) and San Diego Gas and Electric (20%).

Unit 2 and Unit 3 were supplied by Combustion Engineering, Inc., with turbine generators supplied by G.E.C. Turbine Generators, Ltd., of England. The units began commercial operation on August 18, 1983, and April 1, 1984, respectively and are rated at 1127 net megawatts electrical each. The twin units are owned by Southern California Edison (78.21%), San Diego Gas and Electric (20%), and the City of Riverside (1.79%).

Effective December 29, 2006, the City of Anaheim transferred its ownership interests in San Onofre Units 2 and 3 and the entitlement to the Units 2 and 3 output, to Southern California Edison Company, except that it retains its ownership interests in its used nuclear fuel and Units 2 and 3's independent spent fuel storage installation located on the facility's site. The City of Anaheim retains financial responsibility for used fuel generated during its ownership and for a portion of the Units 2 and 3 decommissioning costs. The City of Anaheim remains a licensee for purposes of its retained interests and liabilities.

# **San Onofre Nuclear Generating Station**

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# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

### SECTION A. INTRODUCTION

This Annual Radioactive Effluent Release Report summarizes the gaseous and liquid radioactive effluent releases and radwaste shipments made from the San Onofre Nuclear Generating Station. It will also summarize the radwaste shipments from the decommissioning of Unit 1. This report is prepared in the general format of USNRC Regulatory Guide 1.21 and includes:

1. Quarterly Summaries of Gaseous and Liquid Effluents for "Continuous" and "Batch" Modes of Release
2. Percent of Applicable Limits
3. Estimated Total Percent Error
4. Lower Limit of Detection Concentrations
5. Batch Release Summaries
6. Previous Radioactive Effluent Release Report Addendum
7. Radwaste Shipments
8. 10 CFR 50 Appendix I Requirements
9. Changes to Offsite Dose Calculation Manual

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### SECTION B. GASEOUS EFFLUENTS

Table 1A, "Gaseous Effluents-Summation of All Releases," provides a detailed listing of gaseous effluents released quarterly in four categories: fission and activation gases, iodine-131, particulates with half-lives greater than eight days, and tritium. Listed for each of the four categories are:

- (1) the total curies released
- (2) the average release rate
- (3) the percent of applicable limit
- (4) the estimated total error

In addition, the particulate category lists the gross alpha radioactivity released for each quarter.

The methodology used to calculate the percent of Applicable Limit is presented in Section F of this report. The methodology used in Table 1A to calculate the estimated total error is presented in Section G of this report.

Table 1B, "Gaseous Effluents-Elevated Release," has not been included in this report since San Onofre Nuclear Generating Station does not conduct elevated releases.

Table 1C, "Gaseous Effluents-Ground Level Releases," provides the systematic listing by radionuclide for the quantity of radioactivity released in three categories: fission gases, iodines, and particulates. The total radioactivity for each radionuclide is listed for each quarterly period by both "continuous" and "batch" modes of release.

Waste gas decay tank releases are considered to be "batch" releases. Containment purges and plant stack releases are considered to be "continuous" releases.

Table 1D, "Gaseous Effluents-Lower Limit of Detection," provides a listing of lower limit of detection concentrations for radionuclides not detected in Tables 1A and 1C.

Table 1E, "Gaseous Effluents-Radiation Doses at the Site Boundary," provides a quarterly summary of doses at the site boundary for this report period.

Table 1F, "Gaseous Effluents-Batch Release Summary," provides summary information regarding batch releases conducted during this report period from San Onofre Nuclear Generating Station.

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TABLE 1A

## GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

		Unit	First Quarter	Second Quarter	Estimated Total Error, %
A. Fission and activation gases					
1.	Total release	Ci	2.07E+1	2.62E+1	3.00E+1
2.	Average release rate for period	μCi/sec	2.67E+0	3.33E+0	
3.	Percent of applicable limit	% MPC	6.82E-3	6.10E-3	
4.	Percent Effluent Concentration Limit	% ECL	1.40E-2	6.65E-3	
B. Iodines					
1.	Total iodine-131 <sup>(1)</sup>	Ci	1.02E-5	3.09E-5	1.90E+1
2.	Average release rate for period	μCi/sec	1.31E-6	3.93E-6	
3.	Percent of applicable limit	% MPC	6.30E-6	1.89E-5	
4.	Percent Effluent Concentration Limit	% ECL	3.15E-6	9.43E-6	
C. Particulates					
1.	Particulates with half-lives >8 days <sup>(1)</sup>	Ci	1.56E-5	1.66E-5	1.60E+1
2.	Average release rate for period	μCi/sec	2.01E-6	2.12E-6	
3.	Percent of applicable limit	% MPC	6.23E-7	9.80E-7	
4.	Percent Effluent Concentration Limit	% ECL	1.85E-6	4.30E-6	
5.	Gross alpha activity	Ci	<LLD	<LLD	5.00E+1
D. Tritium					
1.	Total release	Ci	2.31E+1	2.05E+1	2.50E+1
2.	Average release rate for period	μCi/sec	2.97E+0	2.61E+0	
3.	Percent of applicable limit	% MPC	7.13E-3	6.26E-3	
4.	Percent Effluent Concentration Limit	% ECL	1.43E-2	1.25E-2	

(1) The following particulate/ iodine samples were missed. Prior and subsequent samples were averaged to estimate any curies released and are included in Table 1A.

Release Pathway	From	To	Notification
Unit 3 Condenser Air Ejector	01/18/2010 0840	01/18/2010 1623	200751121
Unit 3 Condenser Air Ejector	01/21/2010 0851	01/21/2010 1855	200758589



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TABLE 1A (Continued)

## GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	Unit	Third Quarter	Fourth Quarter	Estimated Total Error, %
A. Fission and activation gases				
1. Total release	Ci	2.34E+1	5.60E+1	3.00E+1
2. Average release rate for period	µCi/sec	2.95E+0	7.04E+0	
3. Percent of applicable limit	% MPC	5.29E-3	1.37E-2	
4. Percent Effluent Concentration Limit	% ECL	4.86E-3	1.78E-2	
B. Iodines				
1. Total iodine-131 <sup>(1)</sup>	Ci	6.12E-5	2.43E-4	1.90E+1
2. Average release rate for period	µCi/sec	7.70E-6	3.06E-5	
3. Percent of applicable limit	% MPC	3.70E-5	1.47E-4	
4. Percent Effluent Concentration Limit	% ECL	1.85E-5	7.34E-5	
C. Particulates				
1. Particulates with half-lives >8 days <sup>(1)</sup>	Ci	1.74E-5	4.47E-4	1.60E+1
2. Average release rate for period	µCi/sec	2.19E-6	5.63E-5	
3. Percent of applicable limit	% MPC	2.82E-6	3.94E-5	
4. Percent Effluent Concentration Limit	% ECL	1.64E-5	1.93E-4	
5. Gross alpha activity	Ci	<LLD	<LLD	5.00E+1
D. Tritium				
1. Total release	Ci	1.47E+1	2.42E+1	2.50E+1
2. Average release rate for period	µCi/sec	1.85E+0	3.04E+0	
3. Percent of applicable limit	% MPC	4.44E-3	7.31E-3	
4. Percent Effluent Concentration Limit	% ECL	8.88E-3	1.46E-2	

(1) The following particulate/iodine samples were missed. Prior and subsequent samples were averaged to estimate any curies released and are included in Table 1A.

Release Pathway	From	To	Notification
Unit 2 Condenser Air Ejector	08/06/2010 07:37	08/06/2010 19:05	201051425
Unit 3 Condenser Air Ejector	10/06/2010 00:10	10/06/2010 07:40	201142258
Unit 3 Condenser Air Ejector	10/08/2010 16:30	10/09/2010 02:38	201147162
Unit 2 Condenser Air Ejector	12/10/2010 14:00	12/10/2010 17:07	201239129

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TABLE 1C

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES  
CONTINUOUS MODE

Radionuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1. Fission and activation gases					
argon-41	Ci	1.90E+0	5.93E-1	2.76E-1	1.88E+0
krypton-85	Ci	<LLD	<LLD	<LLD	2.52E-1
krypton-85m	Ci	<LLD	<LLD	2.92E-2	<LLD
krypton-87	Ci	<LLD	<LLD	<LLD	<LLD
krypton-88	Ci	<LLD	<LLD	3.38E-2	<LLD
xenon-131m	Ci	<LLD	<LLD	<LLD	3.24E-2
xenon-133	Ci	1.86E+1	2.30E+1	2.24E+1	5.20E+1
xenon-133m	Ci	<LLD	<LLD	2.94E-2	1.57E-2
xenon-135	Ci	<LLD	<LLD	2.31E-1	1.94E-3
xenon-135m	Ci	<LLD	<LLD	<LLD	<LLD
xenon-138	Ci	<LLD	<LLD	<LLD	<LLD
Total for period	Ci	2.05E+1	2.36E+1	2.30E+1	5.42E+1
2. Iodines					
iodine-131	Ci	1.02E-5	3.09E-5	6.12E-5	2.43E-4
iodine-132	Ci	<LLD	1.17E-7	<LLD	<LLD
iodine-133	Ci	2.66E-5	9.74E-5	7.49E-5	8.89E-5
iodine-135	Ci	<LLD	<LLD	<LLD	<LLD
Total for period	Ci	3.68E-5	1.28E-4	1.36E-4	3.32E-4

LLD Lower Limit of Detection; see Table 1D.

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TABLE 1C (Continued)

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES  
CONTINUOUS MODE

Radionuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
3. Particulates					
antimony-125	Ci	<LLD	<LLD	<LLD	1.18E-5
barium-140	Ci	<LLD	<LLD	<LLD	<LLD
bromine-82	Ci	6.30E-5	5.37E-5	2.77E-5	4.97E-5
cerium-141	Ci	<LLD	<LLD	<LLD	<LLD
cerium-144	Ci	<LLD	<LLD	<LLD	<LLD
cesium-134	Ci	<LLD	<LLD	<LLD	<LLD
cesium-137	Ci	<LLD	<LLD	1.32E-8	6.47E-6
cobalt-58	Ci	1.44E-5	1.07E-5	4.01E-6	2.73E-4
cobalt-60	Ci	7.12E-7	2.91E-6	1.34E-5	1.43E-4
iron-59	Ci	<LLD	<LLD	<LLD	<LLD
lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
manganese-54	Ci	<LLD	<LLD	<LLD	1.30E-5
molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
niobium-95	Ci	3.02E-7	3.03E-6	<LLD	<LLD
silver-110m	Ci	9.03E-8	<LLD	<LLD	<LLD
strontium-89	Ci	<LLD	<LLD	<LLD	<LLD
strontium-90	Ci	<LLD	<LLD	<LLD	<LLD
zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
zirconium-95	Ci	1.19E-7	<LLD	<LLD	<LLD

LLD Lower Limit of Detection; see Table 1D.

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TABLE 1C (Continued)

GASEOUS EFFLUENTS-GROUND LEVEL RELEASES  
BATCH MODE \*

Radionuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1. Fission and activation gases					
krypton-85	Ci	2.71E-1	2.55E+0	4.71E-1	1.81E+0
krypton-85m	Ci	<LLD	<LLD	<LLD	<LLD
krypton-87	Ci	<LLD	<LLD	<LLD	<LLD
krypton-88	Ci	<LLD	<LLD	<LLD	<LLD
xenon-133	Ci	<LLD	<LLD	4.45E-3	<LLD
xenon-133m	Ci	<LLD	<LLD	<LLD	<LLD
xenon-135	Ci	<LLD	<LLD	<LLD	<LLD
xenon-135m	Ci	<LLD	<LLD	<LLD	<LLD
xenon-138	Ci	<LLD	<LLD	<LLD	<LLD
Total for period	Ci	2.71E-1	2.55E+0	4.76E-1	1.81E+0

LLD Lower Limit of Detection; see Table 1D.

\* Iodines and particulates are not analyzed prior to release via batch mode.

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TABLE 1D

GASEOUS EFFLUENTS-LOWER LIMIT OF DETECTION  
CONTINUOUS and BATCH MODE

Radionuclides	Continuous Mode LLD ( $\mu\text{Ci/cc}$ )	Batch Mode LLD ( $\mu\text{Ci/cc}$ )
1. Fission and activation gases		
krypton-85	2.00E-5	*
krypton-85m	4.70E-8	2.10E-6
krypton-87	2.50E-7	9.10E-6
krypton-88	1.70E-7	7.30E-6
xenon-131m	1.60E-6	N/A
xenon-133	*	4.60E-6
xenon-133m	3.80E-7	1.80E-5
xenon-135	5.00E-8	2.30E-6
xenon-135m	1.90E-6	2.80E-5
xenon-138	3.20E-6	4.40E-5
2. Iodines		
iodine-132	1.30E-9	N/A
iodine-135	1.50E-10	N/A
3. Particulates		
antimony-125	2.00E-13	N/A
barium-140	4.60E-13	N/A
cerium-141	5.80E-14	N/A
cerium-144	2.30E-13	N/A
cesium-134	1.30E-13	N/A
cesium-137	1.10E-13	N/A
cobalt-58	1.20E-13	N/A
iron-59	2.90E-13	N/A
lanthanum-140	9.20E-13	N/A
manganese-54	1.20E-13	N/A
molybdenum-99	7.00E-14	N/A
niobium-95	1.20E-13	N/A
silver-110m	1.70E-13	N/A
strontium-89	1.00E-11	N/A
strontium-90	1.00E-11	N/A
zinc-65	3.10E-13	N/A
zirconium-95	2.00E-13	N/A
4. alpha	1.00E-11	N/A

\* Radionuclide was &gt;LLD in all 4 quarters.

N/A Radionuclide not detected or not analyzed for via the batch mode

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TABLE 1E

## GASEOUS EFFLUENTS-RADIATION DOSES AT THE SITE BOUNDARY

	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
A. Noble Gas					
1. Gamma Air Dose	mrad	3.69E-3	2.08E-3	1.75E-3	5.47E-3
2. Percent Applicable Limit	%	3.69E-2	2.08E-2	1.75E-2	5.47E-2
3. Beta Air Dose	mrad	4.00E-3	4.73E-3	3.97E-3	9.87E-3
4. Percent Applicable Limit	%	2.00E-2	2.36E-2	1.98E-2	4.94E-2
B. Tritium, Iodine, Particulates (at the nearest receptor)					
1. Organ Dose	mrem	3.46E-3	3.03E-3	2.44E-3	6.45E-3
2. Percent Applicable Limit	%	2.31E-2	2.02E-2	1.63E-2	4.30E-2

NOTE: Calculations performed in accordance with the ODCM utilizing the historical X/Q.

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TABLE 1F

GASEOUS EFFLUENTS-BATCH RELEASE SUMMARY

	12 month period
1. Number of batch releases:	6 releases
2. Total time period for batch releases:	2653 minutes
3. Maximum time period for a batch release:	650 minutes
4. Average time period for a batch release:	442 minutes
5. Minimum time period for a batch release:	303 minutes

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### SECTION C. LIQUID EFFLUENTS

Table 2A, "Liquid Effluents-Summation of All Releases," provides a detailed summary of liquid effluents released quarterly in three categories: fission and activation products, tritium, and dissolved and entrained gases. Listed for each of the three categories are:

- (1) the total curies released
- (2) the average diluted concentration
- (3) the percent of applicable limit
- (4) the estimated total error

In addition, Table 2A lists:

- (1) the gross alpha radioactivity
- (2) the volume of waste released (prior to dilution)
- (3) the volume of dilution water

The methodology used to calculate the percent of applicable limit is presented in Section F of this report. The methodology used to calculate the estimated total error in Table 2A is presented in Section G of this report.

Table 2B, "Liquid Effluents," provides the systematic listing by radionuclide for the quantity of radioactivity released in each category. The total radioactivity of each radionuclide released is listed for each quarterly period by both "continuous" and "batch" modes of release.

Table 2C, "Liquid Effluents-Lower Limit of Detection," provides a listing of lower limit of detection concentrations for radionuclides not detected in Table 2B.

Table 2D, "Liquid Effluents-Radiation Doses at the Liquid Site Boundary," presents a quarterly summary of doses at the Liquid Site Boundary for this report period.

Table 2E, "Liquid Effluents-Batch Release Summary," provides summary information regarding batch releases conducted during this report period from San Onofre Nuclear Generating Station.



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TABLE 2A

## LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES

		Unit	First Quarter	Second Quarter	Estimated Total Error, %
A. Fission and activation products					
1.	Total release (not including tritium, gases, alpha)	Ci	4.63E-4	1.77E-2	1.90E+1
2.	Average diluted concentration during period	μCi/ml	7.15E-13	2.33E-11	
3.	Percent of applicable limit	% MPC	4.36E-6	5.56E-5	
4.	Percent Effluent Concentration Limit	% ECL	9.27E-6	1.02E-4	
B. Tritium					
1.	Total release	Ci	6.93E+1	3.85E+1	1.90E+1
2.	Average diluted concentration during period	μCi/ml	1.07E-7	5.06E-8	
3.	Percent of applicable limit	% MPC	3.57E-3	1.69E-3	
4.	Percent Effluent Concentration Limit	% ECL	1.07E-2	5.06E-3	
C. Dissolved and entrained gases					
1.	Total release	Ci	1.03E-4	<LLD	1.90E+1
2.	Average diluted concentration during period	μCi/ml	1.59E-13	N/A	
3.	Percent of applicable limit	% MPC	7.96E-8	N/A	
4.	Percent Effluent Concentration Limit	% ECL	7.96E-8	N/A	
D. Gross alpha radioactivity					
1.	Total release	Ci	<LLD	<LLD	5.00E+1
E. Volume of waste released (batch & continuous, prior to dilution)		liters	3.72E+7	6.91E+7	5.00E+0
F. Volume of dilution water used during period		liters	6.47E+11	7.61E+11	5.00E+0

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TABLE 2A (Continued)

## LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES

		Unit	Third Quarter	Fourth Quarter	Estimated Total Error, %
A. Fission and activation products					
1.	Total release (not including tritium, gases, alpha)	Ci	3.14E-3	1.03E-2	1.90E+1
2.	Average diluted concentration during period	µCi/ml	4.06E-12	2.06E-11	
3.	Percent of applicable limit	% MPC	1.01E-5	3.29E-5	
4.	Percent Effluent Concentration Limit	% ECL	1.00E-4	2.76E-4	
B. Tritium					
1.	Total release	Ci	4.40E+2	3.21E+2	1.90E+1
2.	Average diluted concentration during period	µCi/ml	5.69E-7	6.42E-7	
3.	Percent of applicable limit	% MPC	1.90E-2	2.14E-2	
4.	Percent Effluent Concentration Limit	% ECL	5.69E-2	6.42E-2	
C. Dissolved and entrained gases					
1.	Total release	Ci	1.55E-1	9.99E-2	1.90E+1
2.	Average diluted concentration during period	µCi/ml	2.00E-10	2.00E-10	
3.	Percent of applicable limit	% MPC	1.00E-4	9.99E-5	
4.	Percent Effluent Concentration Limit	% ECL	1.00E-4	9.99E-5	
D. Gross alpha radioactivity					
1.	Total release	Ci	<LLD	<LLD	5.00E+1
E.	Volume of waste released (batch & continuous, prior to dilution)	liters	6.28E+7	6.02E+7	5.00E+0
F.	Volume of dilution water used during period	liters	7.73E+11	5.00E+11	5.00E+0

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TABLE 2B

LIQUID EFFLUENTS  
CONTINUOUS MODE

Radionuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1. Fission and activation products					
barium-140	Ci	<LLD	<LLD	<LLD	<LLD
cerium-141	Ci	<LLD	<LLD	<LLD	<LLD
cerium-144	Ci	<LLD	<LLD	<LLD	<LLD
cesium-134	Ci	<LLD	<LLD	<LLD	<LLD
cesium-137	Ci	<LLD	<LLD	<LLD	<LLD
chromium-51	Ci	<LLD	<LLD	<LLD	<LLD
cobalt-58	Ci	<LLD	<LLD	<LLD	<LLD
cobalt-60	Ci	<LLD	<LLD	<LLD	<LLD
iodine-131	Ci	<LLD	<LLD	<LLD	<LLD
iron-55	Ci	<LLD	<LLD	<LLD	<LLD
iron-59	Ci	<LLD	<LLD	<LLD	<LLD
lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
manganese-54	Ci	<LLD	<LLD	<LLD	<LLD
molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
niobium-95	Ci	<LLD	<LLD	<LLD	<LLD
sodium-24	Ci	<LLD	9.44E-3	<LLD	<LLD
strontium-89	Ci	<LLD	<LLD	<LLD	<LLD
strontium-90	Ci	<LLD	<LLD	<LLD	<LLD
technetium-99m	Ci	<LLD	<LLD	<LLD	<LLD
zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
zirconium-95	Ci	<LLD	<LLD	<LLD	<LLD
Total for period	Ci	<LLD	9.44E-3	<LLD	<LLD
2. Dissolved and entrained gases					
xenon-133	Ci	<LLD	<LLD	<LLD	<LLD
xenon-135	Ci	<LLD	<LLD	<LLD	<LLD
Total for period	Ci	<LLD	<LLD	<LLD	<LLD

LLD Lower Limit of Detection; see Table 2C

## ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

TABLE 2B (Continued)

LIQUID EFFLUENTS  
BATCH MODE

Radionuclides Released	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
1. Fission and activation products					
antimony-125	Ci	1.96E-4	1.34E-4	3.59E-4	8.92E-4
barium-140	Ci	<LLD	<LLD	<LLD	<LLD
cerium-141	Ci	<LLD	<LLD	<LLD	3.59E-5
cerium-144	Ci	<LLD	<LLD	<LLD	<LLD
cesium-134	Ci	6.01E-6	<LLD	8.55E-5	8.05E-5
cesium-137	Ci	1.81E-5	<LLD	2.28E-4	7.17E-4
chromium-51	Ci	<LLD	<LLD	<LLD	1.78E-3
cobalt-57	Ci	<LLD	1.28E-5	1.58E-5	<LLD
cobalt-58	Ci	8.09E-5	9.55E-4	7.52E-4	2.75E-3
cobalt-60	Ci	5.70E-5	1.21E-3	1.13E-3	7.46E-4
iodine-131	Ci	<LLD	<LLD	<LLD	<LLD
iron-55	Ci	<LLD	3.34E-3	<LLD	2.39E-3
iron-59	Ci	<LLD	<LLD	<LLD	1.18E-4
lanthanum-140	Ci	<LLD	<LLD	<LLD	<LLD
manganese-54	Ci	3.58E-6	2.79E-4	1.61E-4	1.15E-4
molybdenum-99	Ci	<LLD	<LLD	<LLD	<LLD
niobium-95	Ci	1.40E-5	9.09E-4	2.51E-4	2.04E-4
niobium-97	Ci	<LLD	1.19E-5	<LLD	<LLD
ruthenium-106	Ci	<LLD	<LLD	<LLD	3.04E-4
silver-110m	Ci	1.49E-5	8.68E-5	3.13E-5	<LLD
sodium-24	Ci	<LLD	8.76E-4	<LLD	<LLD
strontium-89	Ci	<LLD	<LLD	<LLD	<LLD
strontium-90	Ci	<LLD	<LLD	<LLD	<LLD
technetium-99m	Ci	<LLD	<LLD	<LLD	<LLD
tin-113	Ci	<LLD	3.73E-5	<LLD	<LLD
tin-117m	Ci	6.31E-5	3.00E-6	<LLD	4.11E-5
zinc-65	Ci	<LLD	<LLD	<LLD	<LLD
zirconium-95	Ci	8.76E-6	4.48E-4	1.25E-4	9.70E-5
Total for period	Ci	4.63E-4	8.30E-3	3.14E-3	7.89E-3
2. Dissolved and entrained gases					
krypton-85	Ci	<LLD	<LLD	6.42E-2	9.95E-2
xenon-131m	Ci	<LLD	<LLD	3.47E-3	4.35E-5
xenon-133	Ci	1.03E-4	<LLD	8.68E-2	3.60E-4
xenon-133m	Ci	<LLD	<LLD	1.67E-4	<LLD
xenon-135	Ci	<LLD	<LLD	<LLD	<LLD
Total for period	Ci	1.03E-4	<LLD	1.55E-1	9.99E-2

LLD Lower Limit of Detection; see Table 2C.

## ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

TABLE 2C

## LIQUID EFFLUENTS-LOWER LIMIT OF DETECTION

Radionuclides	LLD ( $\mu\text{Ci/ml}$ ) Continuous Mode	LLD ( $\mu\text{Ci/ml}$ ) Batch Mode
1. Fission and activation products		
barium-140	3.00E-7	2.50E-7
cerium-141	4.60E-8	4.30E-8
cerium-144	1.90E-7	1.90E-7
cesium-134	7.90E-8	7.80E-8
cesium-137	6.70E-8	6.70E-8
chromium-51	3.50E-7	3.20E-7
cobalt-57	N/A	2.40E-8
cobalt-58	7.10E-8	*
cobalt-60	1.10E-7	*
iodine-131	6.10E-8	4.60E-8
iron-55	1.00E-6	1.00E-6
iron-59	1.70E-7	1.60E-7
lanthanum-140	5.90E-7	1.90E-7
manganese-54	7.00E-8	*
molybdenum-99	6.10E-8	2.80E-8
niobium-95	7.10E-8	*
niobium-97	N/A	1.60E-7
ruthenium-106	N/A	5.50E-7
silver-110m	N/A	1.00E-7
sodium-24	9.50E-7	3.30E-7
strontium-89	5.00E-8	5.00E-8
strontium-90	5.00E-8	5.00E-8
technetium-99m	6.20E-8	2.90E-8
tin-113	N/A	5.70E-8
tin-117m	N/A	2.50E-8
zinc-65	1.80E-7	1.80E-7
zirconium-95	1.20E-7	*
2. Dissolved and entrained gases		
krypton-85	N/A	3.10E-5
xenon-131m	N/A	3.20E-6
xenon-133	2.60E-7	2.60E-7
xenon-133m	N/A	7.30E-7
xenon-135	9.40E-8	9.40E-8
3. gross alpha		
	1.00E-7	1.00E-7

\* Radionuclide was >LLD in all 4 quarters.

N/A Radionuclide not detected in continuous flow paths

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## SAN ONOFRE NUCLEAR GENERATING STATION

TABLE 2D

## LIQUID EFFLUENTS-RADIATION DOSES AT THE LIQUID SITE BOUNDARY

	Unit	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
A.					
1. Total body dose	mrem	1.20E-4	2.66E-4	7.88E-4	7.87E-4
2. Percent Applicable Limit	%	3.99E-3	8.87E-3	2.63E-2	2.62E-2
B.					
1. Limiting organ dose	mrem	2.70E-4	1.22E-3	1.16E-3	1.92E-3
2. Percent Applicable Limit	%	2.70E-3	1.22E-2	1.16E-2	1.92E-2
3. Limiting organ for period		GI/LLI	GI/LLI	GI/LLI	GI/LLI

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TABLE 2E

LIQUID EFFLUENTS-BATCH RELEASE SUMMARY

	12 month period
1. Number of batch releases:	212 releases
2. Total time period for batch releases:	32971 minutes
3. Maximum time period for a batch release:	1573 minutes
4. Average time period for a batch release:	156 minutes
5. Minimum time period for a batch release:	86 minutes
6. Average saltwater flow during batch releases:	739127 gpm

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SECTION D. PREVIOUS RADIOACTIVE EFFLUENT RELEASE REPORT ADDENDUM

NONE.



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## SAN ONOFRE NUCLEAR GENERATING STATION

SECTION E. RADWASTE SHIPMENTS

TABLE 3 (Units 2 &amp; 3)

## SOLID WASTE AND IRRADIATED FUEL SHIPMENT

## A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

1. Type of waste	Unit	12 month period	Estimated total error (%)
a. Spent resins, filter sludges	m <sup>3</sup>	N/A	N/A
	Ci	N/A	
b. Dry active waste (DAW), compactable and non-compactable	m <sup>3</sup>	4.08E+2	3.00E+1
	Ci	4.43E-1	
c. Irradiated components	m <sup>3</sup>	N/A	N/A
	Ci	N/A	
d. Other: Filters	m <sup>3</sup>	N/A	N/A
	Ci	N/A	

Note: Total curie content estimated.

N/A No shipment made.

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

### A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

2. Estimate of Major Nuclide Composition (by type of waste)		
a. not applicable	%	N/A
b. antimony-125	%	6.56E-01
carbon-14	%	2.12E+00
cerium-144	%	7.32E-02
cesium-137	%	3.13E+00
cobalt-57	%	8.87E-02
cobalt-58	%	5.28E+00
cobalt-60	%	1.85E+01
iron-55	%	3.90E+01
iron-59	%	1.33E-01
manganese-54	%	2.28E+00
nickel-63	%	2.01E+01
niobium-95	%	9.75E-01
strontium-89	%	3.30E-01
technetium-99	%	6.75E+00
zirconium-95	%	4.88E-01
c. not applicable	%	N/A
d. not applicable	%	N/A

## ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

## A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

3. Solid Waste Disposition		
Number of Shipments	Mode of Transportation	Destination
19 *	Truck / Flatbed Trailer	EnergySolutions Duratek
8	Truck / Flatbed Trailer	EnergySolutions Clive Utah
2 **	Truck / Flatbed Trailer	PermaFix Diversified Scientific Services, Inc. (DSSI)

\* SCE maintains contracts with Duratek for volume reduction services. The processed volume was shipped from the EnergySolutions Duratek facilities to EnergySolutions Utah Burial Site using 34 shipments. Those 34 shipments included waste from other generators. SCE's waste volume was a fraction of the total waste volume of these shipments.

\*\* SEC maintains contracts with PermaFix/DSSI for volume reduction services. The waste was destroyed (burned) per applicable regulations. Due to the method of destruction, the residual waste becomes PermaFix/DSSI secondary waste which was disposed of at the EnergySolutions Utah Burial Site. Therefore, there is no burial volume associated with this waste.

## B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
None	No shipments were made	N/A

## C. DEWATERING

Number of Containers	Solidification Agent
None	N/A

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SAN ONOFRE NUCLEAR GENERATING STATION

SECTION E. RADWASTE SHIPMENTS

TABLE 3 (Decommissioned Unit 1)

SOLID WASTE AND IRRADIATED FUEL SHIPMENT

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

Number of Shipments	Mode of Transportation	Destination
None	No shipments were made	N/A

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
None	No shipments were made	N/A

C. DEWATERING

Number of Containers	Solidification Agent
None	N/A

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## SAN ONOFRE NUCLEAR GENERATING STATION

SECTION E. RADWASTE SHIPMENTS

## COMMON RADWASTE SHIPMENTS

TABLE 3 (COMMON)

## SOLID WASTE AND IRRADIATED FUEL SHIPMENT

## A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

1. Type of waste	Unit	12 month period	Estimated total error (%)
a. Spent resins, filter sludges, evaporator bottoms	m <sup>3</sup>	N/A	N/A
	Ci	N/A	
b. Dry active waste (DAW), compactable and non-compactable	m <sup>3</sup>	N/A	N/A
	Ci	N/A	
c. Irradiated components	m <sup>3</sup>	N/A	N/A
	Ci	N/A	
d. Other (filters)	m <sup>3</sup>	N/A	N/A
	Ci	N/A	

N/A No shipment made.

2. Estimate of major nuclide composition (by type of waste)		
a. not applicable	%	N/A
b. not applicable	%	N/A
c. not applicable	%	N/A
d. not applicable	%	N/A

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SAN ONOFRE NUCLEAR GENERATING STATION

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (Not Irradiated Fuel)

3. Solid Waste Disposition (SONGS 1, 2, and 3)		
Number of Shipments	Mode of Transportation	Destination
None	No shipments were made	N/A

B. IRRADIATED FUEL SHIPMENTS (Disposition)

Number of Shipments	Mode of Transportation	Destination
None	No shipments were made	N/A

C. DEWATERING

Number of Containers	Solidification Agent
None	N/A

D. CHANGES TO THE PROCESS CONTROL PROGRAM AT SAN ONOFRE UNITS 1, 2, & 3

None.

REFERENCES:

1. Unit 1 Technical Specifications, section D6.13.2.
2. Units 2 and 3 License Controlled Specifications, Section 5.0.103.2.2.

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

### SECTION F. APPLICABLE LIMITS

#### Gaseous Effluents - Applicable Limits

The percent of Applicable Limits, tabulated in Sections A, B, C, and D of Table 1A, were calculated using the following equation:

$$\bullet \quad \% \text{ Applicable Limit} = \frac{(\text{Rel Rate}) (X/Q) (100)}{\text{MPC}_{\text{eff}}}$$

where: Rel Rate = total curies released in each category and each quarter, divided by the seconds in a quarter; the value in Sections A.2, B.2, C.2 and D.2 of Table 1A,  $\mu\text{Ci/sec}$ .

X/Q =  $4.80\text{E-}6 \text{ sec/m}^3$ ; the annual average atmospheric dispersion defined in the ODCM.

$$\bullet \quad \text{MPC}_{\text{eff}} = \frac{1}{\sum_{i=1}^n \frac{F_i}{\text{MPC}_i}}$$

where:  $F_i$  = fractional abundance of the  $i^{\text{th}}$  radionuclide obtained by dividing the activity (curies) for each radionuclide,  $C_i$ , by the sum of all the isotopic activity,  $C_T$ .

n = total number of radionuclides identified

$\text{MPC}_i$  = Maximum Permissible Concentration (MPC) of the  $i^{\text{th}}$  radionuclide from 10 CFR 20 (20.1-20.602), Appendix B, Table II, Column 1.

$$\bullet \quad \% \text{ ECL} = \frac{(\text{Rel Rate}) (X/Q) (100)}{\text{ECL}_{\text{eff}}}$$

where: Rel Rate = total curies released in each category and each quarter, divided by the seconds in a quarter; the value in Sections A.2, B.2, C.2 and D.2 of Table 1A,  $\mu\text{Ci/sec}$ .

X/Q =  $4.80\text{E-}6 \text{ sec/m}^3$ ; the annual average atmospheric dispersion defined in the ODCM.

$$\bullet \quad \text{ECL}_{\text{eff}} = \frac{1}{\sum_{i=1}^n \frac{F_i}{\text{ECL}_i}}$$

where:  $F_i$  = fractional abundance of the  $i^{\text{th}}$  radionuclide obtained by dividing the activity (curies) for each radionuclide,  $C_i$ , by the sum of all the isotopic activity,  $C_T$ .

n = total number of radionuclides identified

$\text{ECL}_i$  = Effluent Concentration Limit (ECL) of the  $i^{\text{th}}$  radionuclide from 10 CFR 20 (20.1001-20.2402), Appendix B, Table 2, Column 1.

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

### SECTION F. APPLICABLE LIMITS (Continued)

#### Liquid Effluents - Applicable Limits

The percent of Applicable Limits, tabulated in Sections A, B, and C of Table 2A, were calculated using the following equations:

- $\% \text{ Applicable Limit} = \frac{(\text{Dil Conc}) (100)}{\text{MPC}_{\text{eff}}}$

where: Dil Conc = total curies released in each category and each quarter divided by the total volume released (sum of Sections E and F in Table 2A); the value in Sections A.2, B.2, and C.2 of Table 2A,  $\mu\text{Ci/ml}$ .

- $\text{MPC}_{\text{eff}} = \frac{1}{\sum_{i=1}^n \frac{F_i}{\text{MPC}_i}}$

where:  $F_i$  = fractional abundance of the  $i^{\text{th}}$  radionuclide obtained by dividing the activity (curies) for each radionuclide,  $C_i$ , by the sum of all the isotopic activity,  $C_T$ .

$n$  = total number of radionuclides identified

$\text{MPC}_i$  = Maximum Permissible Concentration (MPC) of the  $i^{\text{th}}$  radionuclide from 10 CFR 20 (20.1-20.602), Appendix B, Table II, Column 2.

- $\% \text{ ECL} = \frac{(\text{Dil Conc}) (100)}{\text{ECL}_{\text{eff}}}$

where: Dil Conc = total curies released in each category and each quarter divided by the total volume released (sum of Sections E and F in Table 2A); the value in Sections A.2, B.2, and C.2 of Table 2A,  $\mu\text{Ci/ml}$ .

- $\text{ECL}_{\text{eff}} = \frac{1}{\sum_{i=1}^n \frac{F_i}{\text{ECL}_i}}$

where:  $F_i$  = fractional abundance of the  $i^{\text{th}}$  radionuclide obtained by dividing the activity (curies) for each radionuclide,  $C_i$ , by the sum of all the isotopic activity,  $C_T$ .

$n$  = total number of radionuclides identified

$\text{ECL}_i$  = Effluent Concentration Limit (ECL) of the  $i^{\text{th}}$  radionuclide from 10 CFR 20 (20.1001-20.2402), Appendix B, Table 2, Column 2.



# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

### APPENDIX A

#### GASEOUS EFFLUENTS - APPLICABLE LIMITS

- A. Table 1A lists the total curies released and the release rate. The percent of applicable limit compares the released concentrations to the concentration limits of 10 CFR 20, Appendix B, Table II, Column 1.
- B. Table 1E lists the air doses as calculated using the historical X/Q. The air dose due to noble gases released in gaseous effluents from SONGS (per reactor) to areas at and beyond the site boundary shall be limited to the following values:
1. During any calendar quarter:  $\leq 5$  mrad for gamma radiation and  $\leq 10$  mrad for beta radiation.
  2. During any calendar year:  $\leq 10$  mrad for gamma radiation and  $\leq 20$  mrad for beta radiation.
- C. The dose to a Member of the Public from iodines, tritium, and all radionuclides in particulate form with half-lives greater than eight days in gaseous effluents released from SONGS (per reactor) to areas at and beyond the site boundary shall be limited to the following values:
1. During any calendar quarter:  $\leq 7.5$  mrem to any organ.
  2. During any calendar year:  $\leq 15$  mrem to any organ.

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## SAN ONOFRE NUCLEAR GENERATING STATION

### APPENDIX A (Continued)

#### LIQUID EFFLUENTS - APPLICABLE LIMITS

- A. Table 2A lists the total curies released, the diluted concentration, and percent of the applicable limit. The percent of applicable limit compares the diluted concentration of radioactive material released to the concentrations specified in 10 CFR 20, Appendix B, Table II, Column 2 for radionuclides other than dissolved or entrained gases. For dissolved or entrained noble gases, the concentration is limited to  $2.00\text{E-}4 \mu\text{Ci/ml}$ .
- B. Table 2D lists doses due to liquid releases. The dose commitment to a Member of the Public from radioactive materials in liquid effluents released from SONGS (per reactor) to unrestricted areas shall be limited to the following values:
1. During any calendar quarter:  $\leq 1.5$  mrem to the total body and  $\leq 5$  mrem to any organ.
  2. During any calendar year:  $\leq 3$  mrem to the total body and  $\leq 10$  mrem to any organ.

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## SAN ONOFRE NUCLEAR GENERATING STATION

### SECTION G. ESTIMATION OF ERROR

Estimations of the error in reported values of gaseous and liquid effluents releases have been made.

Sources of error for gaseous effluents - batch releases are:

- (1) tank volumes
- (2) sampling
- (3) counting
- (4) calibration

Sources of error for gaseous effluents - continuous releases are:

- (1) fan flow rate
- (2) sampling
- (3) counting
- (4) calibration
- (5) differential pressure drop

Sources of error for liquid effluents - batch releases are:

- (1) tank volumes
- (2) sampling
- (3) counting
- (4) calibration

Sources of error for liquid effluents - continuous releases are:

- (1) dilution flow rate
- (2) sampling
- (3) counting
- (4) calibration

These sources of error are independent, and thus, the total error is calculated according to the following formula:

$$\text{Total Error} = \sqrt{\sigma_1^2 + \sigma_2^2 + \sigma_3^2 + \dots + \sigma_i^2}$$

where:  $\sigma_i$  = Error associated with each component.

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### SAN ONOFRE NUCLEAR GENERATING STATION

#### SECTION H. 10 CFR 50 APPENDIX I REQUIREMENTS

Table 1 in Section H presents the quarterly and annual maximum dose to an individual. Six different categories are presented:

- (1) Liquid Effluents - Whole Body
- (2) Liquid Effluents - Organ
- (3) Airborne Effluents - Tritium, Iodines and Particulates
- (4) Noble Gases - Gamma
- (5) Noble Gases - Beta
- (6) Direct Radiation

The doses for categories 1 and 2 were calculated using the methodology of the ODCM; these data are also presented in Table 2D. Categories 3, 4, and 5 were calculated utilizing RETDAS (Radioactive Effluent Tracking and Dose Assessment Software), Regulatory Guide 1.109 methodology, and concurrent meteorology. Table 1E of gaseous effluents previously presented, however, lists data similar to categories 3, 4 and 5 using methods described in the ODCM and the historical meteorology (X/Q). Category 6 presents direct dose data measured by TLD dosimeters. Each portion of each category is footnoted to briefly describe each maximum individual dose presented.

For members of the public, per the ODCM, who may at times be within the site boundary<sup>1</sup>, the occupancy of the individual will be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the site boundary. For members of the public who traverse the site boundary via highway I-5, the residency time shall be considered negligible and hence the dose "0".

Table 2 in Section H presents the percent of Applicable Limits for each dose presented in Table 1.

<sup>1</sup> ODCM Figures 1-2 & 2-2.

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## SAN ONOFRE NUCLEAR GENERATING STATION

TABLE 1

SOURCE	Dose * (millirems)				
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Year
LIQUID EFFLUENTS	1)	2)	3)	4)	5)
Whole Body	1.20E-4	2.66E-4	7.88E-4	7.87E-4	1.96E-3
Organ	6)	7)	8)	9)	10)
	2.70E-4	1.22E-3	1.16E-3	1.92E-3	4.56E-3
AIRBORNE EFFLUENTS	11)	12)	13)	14)	15)
Tritium, Iodines, and Particulates	5.98E-3	3.41E-3	3.89E-3	7.89E-3	2.12E-2
NOBLE GASES **	16)	17)	18)	19)	20)
Gamma	1.74E-2	6.95E-3	4.06E-3	2.12E-2	4.96E-2
Beta	21)	22)	23)	24)	25)
	1.95E-2	1.46E-2	9.12E-3	4.06E-2	8.38E-2
DIRECT RADIATION	26)	27)	28)	29)	30)
	1.36E-1	1.27E-1	1.28E-1	1.18E-1	4.76E-1

\* The numbered footnotes below briefly explain how each maximum dose was calculated, including the organ and the predominant pathway(s).

\*\* Noble gas doses due to airborne effluent are in units of mrad, reflecting the air dose.

1. This value was calculated using the methodology of the ODCM.
2. This value was calculated using the methodology of the ODCM.
3. This value was calculated using the methodology of the ODCM.
4. This value was calculated using the methodology of the ODCM.
5. This value was calculated using the methodology of the ODCM.
6. This value was calculated using the methodology of the ODCM; the GI-LLI received the maximum dose primarily by the saltwater fish pathway.
7. This value was calculated using the methodology of the ODCM; the GI-LLI received the maximum dose primarily by the saltwater fish pathway.

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### SAN ONOFRE NUCLEAR GENERATING STATION

8. This value was calculated using the methodology of the ODCM; the GI-LLI received the maximum dose primarily by the saltwater fish pathway.
9. This value was calculated using the methodology of the ODCM; the GI-LLI received the maximum dose primarily by the saltwater fish pathway.
10. This value was calculated using the methodology of the ODCM; the GI-LLI received the maximum dose primarily by the saltwater fish pathway.
11. The maximum organ dose was to a child's thyroid and was located in the NNW sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
12. The maximum organ dose was to a child's thyroid and was located in the NNW sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
13. The maximum organ dose was to a child's thyroid and was located in the NNW sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
14. The maximum organ dose was to a child's thyroid and was located in the NNW sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
15. The maximum organ dose was to a child's thyroid and was located in the NNW sector. This was calculated using the assumptions of USNRC Regulatory Guide 1.109.
16. The maximum air dose for gamma radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
17. The maximum air dose for gamma radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
18. The maximum air dose for gamma radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
19. The maximum air dose for gamma radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
20. The maximum air dose for gamma radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
21. The maximum air dose for beta radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
22. The maximum air dose for beta radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
23. The maximum air dose for beta radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
24. The maximum air dose for beta radiation was located in the NNE sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
25. The maximum air dose for beta radiation was located in the NNW sector, at the exclusion area boundary, and calculated using the assumptions of the USNRC Regulatory Guide 1.109.
26. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the WSW sector.

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27. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the WSW sector.
28. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the S sector.
29. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the W sector.
30. Measurements were made using TLD dosimeters; values are presented as site wide dose and are prorated to 300 hours per year; highest dose was measured at the Site Boundary in the WSW sector.

TABLE 2

SOURCE	Percent Applicable Limit				
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Year
LIQUID EFFLUENTS					
Whole Body	3.99E-3	8.87E-3	2.63E-2	2.62E-2	3.27E-2
Organ	2.70E-3	1.22E-2	1.16E-2	1.92E-2	2.28E-2
AIRBORNE EFFLUENTS					
Tritium, Iodines, and Particulates	3.98E-2	2.27E-2	2.59E-2	5.26E-2	7.05E-2
NOBLE GASES					
Gamma	1.74E-1	6.95E-2	4.06E-2	2.12E-1	2.48E-1
Beta	9.76E-2	7.29E-2	4.56E-2	2.03E-1	2.09E-1

NOTE: Direct Radiation is not specifically addressed in the Applicable Limits.

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### SECTION I. CHANGES TO THE OFFSITE DOSE CALCULATION MANUAL

On April 23, 2010, Revision 4 of the SONGS Offsite Dose Calculation Manual (ODCM) was adopted and published. This change incorporated changes due to the Safety Evaluation performed for Amendment No. 165 to Facility Operating License No. DPR-13, SONGS, Unit 1. This amendment changed the total dose calculation to consider the hypothetical contribution to public dose from the residual contamination in the Unit 1 conduit.

An effluent ODCM evaluation review was required and performed for the changes.

On March 17, 2011, Revision 5 of the SONGS Offsite Dose Calculation Manual (ODCM) was adopted and published. This change incorporated the following:

1. Incorporated the latest updates related to the 2010 Land Use Census (LUC) from the J.W. Scott to L. McCann Memorandum for File, "2011 Dose Parameters for San Onofre Units 2 and 3," dated January 27, 2011 and Memorandum for File, "2011 Dose Parameters for San Onofre Nuclear Generating Station South Yard Facility and North Industrial Area", dated February 8, 2011,
2. Deleted "type of samples and sampling location" in Table 5-4, per the Memorandum for File, "ODCM Table 5-4 revision recommendations", dated February 23, 2011.

An effluent ODCM evaluation review was required and performed for the changes.

None of the changes impacted the accuracy or reliability of effluent dose or setpoint calculations. The level of radioactive effluent control required by 10CFR20, 40CFR190, 10CFR50.35a and Appendix I to 10CFR50 will be maintained.

Throughout the document, change bars are marked in one of four ways as follows:

- A Addition
- D Deletion
- F Editorial/Format change
- R Revision

Page #	changes due to Revision 4	Reason
Title Pages	Changed from previous revision to Rev 4	R
Page #	Revision 4 changes due to Safety Evaluation performed for Amendment No. 165 to Facility Operating License No. DPR-13, SCE, SONGS Unit 1	Reason
3-4	Revised equation 3-3 , added factor D(U1) to table and added Reference	R
3-5	Corrected equation 3-4	F
Page #	changes due to Land Use Census (LUC)	Reason
2-29	Revised Units 2&3 Controlling Location Factors (CLF)	R
2-30	Revise South Yard Facility CLFs	R
2-31	Revise North Industrial Area CLFs	R
Ai	Updated LUC references	R
A1-5	Added - Sector Q, St Park Office Trlr	A
A1-6	Added - Sector Q, Surf Beach/Guard Shack	A
A1-12	Format change - former page A1-10, Sector R, San Onofre III Housing, revised values per LUC	R



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A1-13	Format change - former page A1-11, Sector R, Deer Consumer/Hunter, revised values per LUC	R
A1-14	Added - Sector R, Camp San Mateo STP	A
A1-15	Format change - former page A1-12, Sector A, Camp Mesa, revised values per LUC	R
A1-16	Format change - former page A1-14, Sector A, Deer Consumer/ Hunter, revised values per LUC	R
A1-18	Added - Sector A, Deer Consumer/Hunter	A
A1-19	Format change - former page A1-16, Sector B, Deer Consumer/ Hunter, revised values per LUC	R
A1-20	Format change - former page A1-15, Sector B, Sanitary Landfill, revised values per LUC	R
A1-21	Added - Sector B, Deer Consumer/Hunter	A
A1-22	Added - Sector B, Deer Consumer/Hunter	A
A1-23	Added - Sector C, Sewage Treat. Facility	A
A1-24	Added - Sector C, Camp San Onofre Fr. Stn	A
A1-26	Format change - former page A1-17, Sector C, Deer Consumer/Hunter, revised values per LUC	R
A1-27	Added - Sector C, Deer Consumer/Hunter	A
A1-28	Format change - former page A1-19, Sector D, Deer Consumer/Hunter, revised values per LUC	R
A1-29	Added - Sector D, Deer Consumer/Hunter	A
A1-31	Format change - former page A1-21, Sector E, Deer Consumer/Hunter, revised values per LUC	R
A1-32	Added - Sector E, Deer Consumer/Hunter	A
A1-33	Added - Sector E, Deer Consumer/Hunter	A
A1-34	Added - Sector E, Deer Consumer/Hunter	A
A1-37	Added - Sector F, Deer Consumer/Hunter	A
A1-38	Added - Sector F, Border Patrol Checkpt	A
A1-39	Added - Sector F, Deer Consumer/Hunter	A
A1-41	Added - Sector G, YMCA Surf Camp/Res	A
A1-42	Added - Sector G, Highway Patrol Weigh Stn	A
A2-1	Deleted - Sector D, Camp Horno Sewage Trmnt.	D
	Added - Sector P, Surf Beach/Life Guard	A
A2-2	Deleted - Sector D, Camp Horno	D
	Added - Sector P, Sorb Resident/Campground	A
A2-3	Added - Sector P, Cotton Point Estates	A
A2-4	Added - Sector P, Cotton Point Gardens	A
A2-5	Added - Sector Q, St Park Office Trlr	A
A2-6	Added - Sector Q, Surf Beach/Guard Shack	A

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A2-7	Added - Sector Q, Sorb Resdnt/Campground	A
A2-8	Added - Sector Q, San Onofre III Housing	A
A2-9	Deleted - Sector G, Sheep (Meat)/Shepherd	D
	Added - Sector Q, San Mateo Pt Homes	A
A2-10	Added - Sector Q, SC Res. With Garden	A
A2-11	Added - Sector R, Camp Mesa	A
A2-12	Added - Sector R, San Onofre III Housing	A
A2-13	Added - Sector A, Camp Mesa	A
A2-14	Added - Sector A, Camp San Mateo	A
A2-15	Added - Sector B, Sanitary Landfill	A
A2-16	Added - Sector C, Sewage Treat. Facility	A
A2-17	Added - Sector C, Camp San Onofre Fr. Stn	A
A2-18	Added -Sector C, Camp San Onofre	A
A2-19	Added - Sector D, Camp San Onofre	A
A2-20	Added - Sector E, Camp Horno	A
A2-21	Added - Sector F, So St. Pk./Guard Shack	A
A2-22	Added - Sector F, Border Patrol Checkpt.	A
A2-23	Format change - former page A2-7, - Sector G, San Onofre Bch Campgd, revised values per LUC	R
A2-24	Added - Sector G, YMCA Surfcamp/Res	A
A2-25	Added - Sector G, Hwy Patrol Weigh Stn	A
A2-26	Added - Sector G, Endls Sum Surfcamp/Res	A
A3-2	Added - Sector P, Sorb Resdnt/Campground	A
A3-4	Format change - former page A3-3, Sector P, Cotton Point Gardens, revised values per LUC	R
A3-5	Added - Sector Q, St Park Office Trlr	A
A3-6	Added - Sector Q, Surf Beach/Guard Shack	A
A3-7	Format change - former page A3-4, Sector Q, Sorb Resdnt/Campground, revised values per LUC	R
A3-8	Format change - former page A3-5, Sector Q, San Onofre III Housing, revised values per LUC	R
A3-9	Format change - former page A3-6, Sector Q, San Mateo Pt Homes, revised values per LUC	R
A3-11	Format change - former page A3-8, Sector R, San Onofre III Housing, revised values per LUC	R
A3-13	Deleted - Sector C, Deer Consumer/Hunter	D
	Format change - former page A3-10, Sector A, Camp San Mateo, revised values per LUC	R
A3-15	Format change - former page A3-12, Sector B, Sanitary Landfill, revised values per LUC	R
A3-16	Deleted - Sector E, Deer Consumer/Hunter	D
	Added - Sector C, Sewage Treat. Facility	A
A3-17	Added - Sector C, Camp San Onofre Fr. Stn	A

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A3-18	Format change - former page A3-14, Sector C, Camp San Onofre, revised values per LUC	R
A3-19	Format change - former page A3-15, Sector D, Camp San Onofre, revised values per LUC	R
A3-20	Format change - former page A3-17, Sector E, Camp Horno, revised values per LUC	R
A3-21	Format change - former page A3-18, Sector F, So St. Pk./Guard Shack, revised values per LUC	R
A3-22	Format change - former page A3-19, Sector F, Border Patrol Checkpt., revised values per LUC	R
A3-23	Format change - former page A3-20, Sector G, San Onofre Bch Campgd, revised values per LUC	R
A3-24	Added - Sector G, YMCA Surfcamp/Res	A
A3-25	Added - Sector G, Hwy Patrol Weigh Stn	A
A3-26	Format change - former page A3-21, Sector G, Endls Sum Surfcamp/Res, revised values per LUC	R
<b>Page #</b>	<b>changes due to Memorandum to file dated February 20, 2009</b>	<b>Reason</b>
5-18	Deleted Airborne Sample and Sampling Location 15, Oceanside City Hall (Control)	D
5-18	Deleted Note for replacing Airborne Sample and Sampling Control Location	D
5-19	Deleted Local Crop location San Clemente Resident w/Garden	D
5-27	Revised Figure 5-5 - Deleted Airborne Sample and Sampling Location 15 for Oceanside City Hall (Control)	R
Appendix B Cover	Revised to Revision 5	R
B3-1 thru B3-14	included memorandum to file from E.S.Goldin, issued 9/10/97 as bases, to support changes to section 5 of the ODCM	R
<b>Page #</b>	<b>changes due to editorial corrections</b>	<b>Reason</b>
A1-1	Format change	F
A1-2	Format change - former page A1-4	F
A1-3	Format change - former page A1-2	F
A1-4	Format change - former page A1-3	F
A1-7	Format change - former page A1-5	F
A1-8	Format change - former page A1-6	F
A1-9	Format change - former page A1-7	F
A1-10	Format change - former page A1-8	F
A1-11	Format change - former page A1-9	F
A1-17	Format change - former page A1-13	F

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A1-25	Format change - former page A1-18	F
A1-30	Format change - former page A1-20	F
A1-35	Format change - former page A1-22	F
A1-36	Format change - former page A1-23	F
A1-40	Format change - former page A1-25	F
A1-43	Format change - former page A1-26	F
A3-1	Format change	F
A3-3	Format change - former page A3-2	F
A3-10	Format change - former page A3-7	F
A3-12	Format change - former page A3-9	F
A3-14	Format change - former page A3-11	F

The Land Use Census (LUC) for 2010 did not identify a new location with a higher calculated or committed dose than those calculated for the locations evaluated in the previous revision to the ODCM. Therefore, no new location(s) are reported per ODCM 5.2.1.

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SECTION J. CHANGES TO RADIOACTIVE WASTE TREATMENT SYSTEMS

None.

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

### SECTION K. MISCELLANEOUS

#### ABNORMAL RELEASES

- U3 High Conductivity Sump Overflow

On 01/31/10 from 1010 to 1030, approximately 15 gallons of water from the Unit 3 High Conductivity Sump (HCS) overflowed and was released to the outfall via the storm drains. A valve clearance caused an unanticipated 250 gpm of water from the demineralized water header to flow to the HCS. Operator actions were taken as soon as the HCS level was observed to be near its high level overflow. The Unit 3 HCS sample contained  $2.70\text{E-}6$  microcuries/milliliter ( $\mu\text{Ci/ml}$ ) of tritium and no detectable gamma emitters. The dose commitment to a member of the public was conservatively calculated to be  $2.57\text{E-}13$  mrem total body and to the organ as a result of this event. This event is documented in Notification 200773694.

- U2/3 Oily Waste Line Leak

The discharge line from the west oily waste sump pump had an aboveground leak from 10/4 to 10/9/2010 that resulted in an estimated 2700 gallons containing  $6.87\text{E-}6$   $\mu\text{Ci/ml}$  of tritium and no detectable gamma emitters to the paved surface. The water was subsequently released to the outfall via the storm drains which is not its designed discharge path. The water originated from the turbine plant sumps which are ODCM-credited release points and has been accounted for in Table 2A of this report. There was no additional dose consequence to a member of the public as a result of this event. This event is documented in Notification 201147182.

- U3 Main Feedwater Block Valve Berm Overflow

From 12/16/10 0145 to 12/22/10 1415, heavy rainfall resulted in the overflow of the berm beneath the Unit 3 Main Feedwater Block valve. Approximately 624 gallons of water containing  $3.99\text{E-}6$   $\mu\text{Ci/ml}$  tritium and no detectable gamma emitters was released from the berm to the outfall via the Unit 3 storm drains. The dose commitment to a member of the public was conservatively calculated to be  $3.22\text{E-}11$  mrem to the total body and to the organ as a result of this event. This event is documented in Notification 201252276.

- U3 Containment Purge Unplanned Monitored Release

On 12/20/10 from 1051 to 1203, during testing of the containment purge valves by Maintenance, the unit 3 containment main purge fan was inadvertently started with the purge valves open or partially open. The release was monitored by Unit 3 containment purge monitor with a maximum release activity of  $5.3\text{E-}6$  microcuries/cubic centimeter. The monitor would have terminated the release before exceeding the limits in 10 CFR 20. The release was evaluated and the associated curies and dose consequences are included in Table 1 of this report. This event is documented in Notification 201262746.

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SECTION K. MISCELLANEOUSEFFLUENT RADIATION MONITORS OUT OF SERVICE GREATER THAN 30 DAYS

January 1, 2010 - December 31, 2010

SONGS 2			
Monitor	Inoperability Period	Inoperability Cause	Explanation
2RT-7870 Condenser Air Ejector Process Flow Monitor	04/17/2000 - present	Inoperable process flow measuring device whenever vacuum pump is running.	Design deficiency causes process flow instrument to be inoperable while the vacuum pump is running, as high flow values are not sensed. Flow monitor works properly during normal operations. The monitor is isokinetic during the vacuum pump operation due to the substitute flow value that is manually inserted whenever the vacuum pump is running. The issue was previously documented in ARs 000101252 and 000400960. It is currently being tracked in NN200001437.
2RT-7870, Condenser Air Ejector Monitor	06/1/2010 - 07/12/2010	Loss of isokinetic control	Loss of isokinetic control due to low sample flow. Replaced sample pump and clogged air dryer 2ME678. Required compensatory samples were collected during this period. The monitor status was tracked by 2EDMR-2010-0095.

SONGS 3			
Monitor	Inoperability Period	Inoperability Cause	Explanation
3RT-7870, Condenser Air Ejector Process Flow Monitor	04/17/2000 - present	Inoperable process flow measuring device whenever vacuum pump is running.	Design deficiency causes process flow instrument to be inoperable while the vacuum pump is running, as high flow values are not sensed. Flow monitor works properly during normal operations. The monitor is isokinetic during the vacuum pump operation due to the substitute flow value that is manually inserted whenever the vacuum pump is running. The issue was previously documented in ARs 000101252 and 000400960. It is currently tracked in NN 200001437.

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## SAN ONOFRE NUCLEAR GENERATING STATION

SECTION K. MISCELLANEOUSONSITE GROUND WATER SAMPLES

This section provides results of on-site samples of ground water in accordance with the voluntary Industry Ground Water Protection Initiative. The data provided on this page are from temporary sample locations as part of an investigation underway in the area formerly occupied by Unit 1. The locations will change as the investigation proceeds and are expected to be discontinued with time.

January 1, 2010 - December 31, 2010

Sample Date	Location	Tritium Activity, $\mu\text{Ci/ml}$	Gamma Activity, $\mu\text{Ci/ml}$
6/22/10	Bore hole 4	-	<LLD
6/23/10	Bore hole 4	3.18E-6	<LLD
	Bore hole 4	2.88E-6	<LLD
	Bore hole 7	1.88E-6	<LLD
6/24/10	Bore hole 3	4.25E-6	<LLD
	Bore hole 14	3.81E-6	<LLD
	Bore hole 15	9.53E-6	<LLD
	Bore hole 16	3.50E-6	<LLD
	Bore hole 17	7.62E-7	<LLD
6/25/10	Bore hole 9	2.01E-6	<LLD
	Bore hole 11	1.11E-5	<LLD
	Bore hole 18	<LLD	<LLD
	Bore hole 19	1.33E-6	<LLD
	Bore hole 20	1.93E-6	<LLD
	Bore hole 22	<LLD	<LLD

*a priori* LLD = H-3: 3.0E-6  $\mu\text{Ci/ml}$

$\mu\text{Ci/ml}$  = indicated microcuries per milliliter



## ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

SECTION K. MISCELLANEOUSONSITE GROUND WATER SAMPLES (Continued)

This section provides results of on-site samples of ground water in accordance with the voluntary Industry Ground Water Protection Initiative. The sample locations and the frequency of sampling may change over time.

January 1, 2010 - December 31, 2010

Sample Date	Location	Tritium Activity, $\mu\text{Ci/ml}$	Gamma Activity, $\mu\text{Ci/ml}$
2/8/10	GW-PA-2	<LLD	<LLD
3/11/10	GW-OCA-1 GW-OCA-2	<LLD <LLD	<LLD <LLD
3/15/10	GW-NIA-1 GW-NIA-2	<LLD 5.52E-7	<LLD <LLD
3/26/10	GW-PA-1 GW-PA-2 GW-PA-3 GW-PA-4	<LLD <LLD <LLD <LLD	<LLD <LLD <LLD <LLD
3/29/10	GW-OCA-3 GW-OCA-3	<LLD <LLD	<LLD <LLD
6/14/10	GW-OCA-1 GW-OCA-2	<LLD <LLD	<LLD <LLD
6/16/10	GW-OCA-3	<LLD	<LLD
6/17/10	GW-OCA-3	<LLD	<LLD
6/23/10	GW-NIA-1 GW-NIA-2	4.70E-7 1.23E-6	<LLD <LLD
6/24/10	GW-PA-1 GW-PA-2 GW-PA-3 GW-PA-4	5.04E-7 <LLD <LLD <LLD	<LLD <LLD <LLD <LLD
9/8/10	GW-NIA-1 GW-NIA-2	<LLD 1.05E-6	<LLD <LLD
9/10/10	GW-PA-1	<LLD	<LLD
9/13/10	GW-PA-2 GW-PA-3 GW-PA-4	<LLD <LLD <LLD	<LLD <LLD <LLD

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

### SECTION K. MISCELLANEOUS

#### ONSITE GROUND WATER SAMPLES (Continued)

Sample Date	Location	Tritium Activity, $\mu\text{Ci/ml}$	Gamma Activity, $\mu\text{Ci/ml}$
9/20/10	GW-OCA-1 GW-OCA-2 GW-OCA-3	<LLD <LLD <LLD	<LLD <LLD <LLD
10/14/10	NIA-3 NIA-4 NIA-5	<LLD <LLD 1.73E-6	<LLD <LLD <LLD
10/21/10	GW-NIA-1 GW-NIA-2	<LLD 1.27E-6	<LLD <LLD
12/23/10	NIA-4 NIA-6 NIA-10 NIA-11 GW-NIA-2	<LLD <LLD <LLD <LLD 1.14E-6	<LLD <LLD <LLD <LLD <LLD
12/27/10	NIA-5 GW-NIA-1	2.10E-6 <LLD	<LLD <LLD

GW-PA = Wells installed in the Protected Area to implement the Ground Water Protection Initiative.

GW-OCA = Wells installed in the Owner Controlled Area to implement the Ground Water Protection Initiative.

GW-NIA = Wells installed in the North Industrial Area to implement the Ground Water Protection Initiative.

*a priori* LLD = H-3: 3.0E-6  $\mu\text{Ci/ml}$

$\mu\text{Ci/ml}$  = indicated microcuries per milliliter

## ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

## SAN ONOFRE NUCLEAR GENERATING STATION

SECTION K. MISCELLANEOUS40 CFR 190 REQUIREMENTS

Table 1 below presents the annual site-wide doses and percent of ODCM Specification limits to members of the public. These values were calculated utilizing doses resulting from all effluent pathways and direct radiation. The different categories presented are: (1) Total Body, (2) Limiting Organ, and (3) Thyroid.

Dose Category	Units	Year
1. Total Body		
a. Total Body Dose	mrem	9.96E-1
b. Percent ODCM Specification Limit	%	3.98E+0
2. Limiting Organ		
a. Organ Dose (GI-LLI)	mrem	2.00E-2
b. Percent ODCM Specification Limit	%	7.98E-2
3. Thyroid		
a. Thyroid Dose	mrem	1.69E-2
b. Percent ODCM Specification Limit	%	2.25E-2

## ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT - 2010

### SAN ONOFRE NUCLEAR GENERATING STATION

#### SECTION L. SONGS CONCLUSIONS

- Gaseous releases totaled  $2.08\text{E}+2$  curies of which noble gases were  $1.26\text{E}+2$  curies, iodines were  $6.33\text{E}-4$  curies, particulates were  $6.91\text{E}-4$  curies, and tritium was  $8.24\text{E}+1$  curies.
- The radiation doses from gaseous releases were: (a) gamma air dose:  $4.96\text{E}-2$  mrad at the site boundary, (b) beta air dose:  $8.38\text{E}-2$  mrad at the site boundary, (c) organ dose:  $2.12\text{E}-2$  mrem at the highest receptor.
- Airborne carbon-14 releases totaled  $2.19\text{E}+1$  curies. The radiation dose from carbon-14 was an organ dose of  $7.77\text{E}-1$  mrem at the highest receptor.
- Liquid releases totaled  $8.69\text{E}+2$  curies of which particulates and iodines were  $3.16\text{E}-2$  curies, tritium was  $8.69\text{E}+2$  curies, and noble gases were  $2.55\text{E}-1$  curies.
- The radiation doses from liquid releases were: (a) total body:  $1.96\text{E}-3$  mrem, (b) limiting organ:  $4.56\text{E}-3$  mrem.
- Radioactive releases and resulting doses generated from SONGS were below the applicable limits for both gaseous and liquid effluents.
- SONGS 2 and 3 made 29 radwaste shipments to EnergySolutions, UT, Duratek/EnergySolutions, TN, and DSSI/PermaFix, TN. The total volume of the 29 shipments was  $4.08\text{E}+2$  cubic meters containing  $4.43\text{E}-1$  curies of radioactivity. There were no radwaste shipments from Unit 1.
- Meteorological conditions during the year were typical for SONGS Meteorological dispersion was good 36% of the time, fair 39% of the time and poor 25% of the time.
- The results of samples taken from on-site ground water wells in support of the industry Ground Water Protection Initiative are reported in Section K. An investigation is being performed in the area formerly occupied by Unit 1 to characterize low, but detectable levels of tritium that are well below all regulatory limits (Notification 201053677). No other licensed radioactive material has been detected in on-site ground water samples. Ground water beneath SONGS is not a source of drinking water.
- The net result from the analysis of these effluent releases indicates that the operation of SONGS has met all the requirements of the applicable regulations that ensure adequate protection of the health of members of the public.

# METEOROLOGY

## **METEOROLOGY**

The meteorology of the San Onofre Nuclear Generating Station for each of the four quarters, 2010 is described in this section. Meteorological measurements have been made according to the guidance provided in NRC Regulatory Guide 1.23, "Onsite Meteorological Programs." A summary report of the meteorological measurements taken during each calendar quarter are presented in Table 4A as joint frequency distribution (JFD) of wind direction and wind speed by atmospheric stability class.

Hourly meteorological data for batch releases have been recorded for the periods of actual release. These data are available, as well as the hourly data for the Annual Report, but have not been included in this report because of the bulk of data records.

Table 4A lists the joint frequency distribution for each quarter, 2010. Each page of Table 4A represents the data for the individual stability classes: A, B, C, D, E, F, and G. The last page of each section is the JFD for all the stability classes. The wind speeds have been measured at the 10-meter level, and the stability classes are defined by the temperature differential between the 10-meter and 40-meter levels.

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

January-March

Table 4A

SITE: SAN ONOFRE  
PERIOD OF RECORD 10010100-10033123  
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL A

EXTREMELY UNSTABLE ( $DT/DZ \leq -1.9^{\circ}\text{C}/100 \text{ METERS}$ )

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	0	1	0	0	0	0	0	0	1
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	1	0	0	0	0	0	0	0	0	0	0	1
SE	0	0	0	1	0	0	0	0	0	0	0	0	1
SSE	0	0	0	1	0	3	4	4	1	0	0	0	13
S	0	0	0	1	3	11	19	2	1	0	0	0	37
SSW	0	0	0	2	8	13	12	0	0	0	0	0	35
SW	0	0	0	4	14	20	6	0	0	0	0	0	44
WSW	0	0	0	3	15	30	12	4	1	0	0	0	65
W	0	0	0	1	9	60	48	5	0	0	0	0	123
WNW	0	0	0	0	3	28	80	8	4	0	0	0	123
NW	0	0	0	0	0	2	15	3	2	0	0	0	22
MNW	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	0	1	0	13	52	168	196	26	9	0	0	0	465
NUMBER OF VALID HOURS					465		NUMBER OF CALMS					0	
NUMBER OF INVALID HOURS					0		TOTAL HOURS FOR THE PERIOD					465	

PASQUILL B

MODERATELY UNSTABLE ( $-1.9 < DT/DZ < -1.7^{\circ}\text{C}/100 \text{ METERS}$ )

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	1	0	0	0	0	0	0	0	1
NNE	0	0	0	0	0	1	0	0	0	0	0	0	1
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	1	0	0	0	0	0	0	0	1
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	3	2	1	0	1	0	7
S	0	0	0	1	1	1	4	0	0	0	0	0	7
SSW	0	0	0	1	2	1	4	0	0	1	0	0	9
SW	0	0	1	0	1	1	2	0	0	0	0	0	5
WSW	0	0	0	0	0	0	0	1	0	0	0	0	1
W	0	0	0	1	4	1	1	0	0	0	0	0	7
WNW	0	0	0	1	2	1	0	0	0	0	0	0	4
NW	0	0	0	1	0	5	2	0	0	0	0	0	8
MNW	0	0	0	0	0	1	0	0	0	0	0	0	1
TOTALS	0	0	1	5	12	12	16	3	1	1	1	0	52
NUMBER OF VALID HOURS					52		NUMBER OF CALMS					0	
NUMBER OF INVALID HOURS					0		TOTAL HOURS FOR THE PERIOD					52	

## ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

January-March

Table 4A

SITE: SAN ONOFRE

PERIOD OF RECORD 10010100-10033123

WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL C

SLIGHTLY UNSTABLE ( $-1.7 < DT/DZ \leq -1.5$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	0	1	0	0	0	0	0	0	1
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	2	0	0	1	0	0	3
SSE	0	0	1	0	1	2	4	6	0	1	0	0	15
S	0	0	0	2	2	0	1	2	1	1	0	0	9
SSW	0	0	0	0	0	2	2	1	0	0	0	0	5
SW	0	0	1	0	3	2	3	1	1	0	0	0	11
WSW	0	0	0	0	1	1	1	1	2	0	0	0	6
W	0	0	0	1	0	1	2	1	1	0	0	0	6
WNW	0	0	0	0	1	2	2	1	0	0	0	0	6
NW	0	0	0	0	1	3	2	1	0	0	0	0	7
MNW	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	0	0	2	3	9	14	19	14	5	3	0	0	69
NUMBER OF VALID HOURS					69	NUMBER OF CALMS					0		
NUMBER OF INVALID HOURS					0	TOTAL HOURS FOR THE PERIOD					69		

PASQUILL D

NEUTRAL ( $-1.5 < DT/DZ \leq -0.5$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	1	6	4	3	3	1	0	0	0	0	18
NNE	0	0	0	0	2	7	4	1	0	0	0	0	14
NE	0	0	0	1	0	1	1	0	0	0	0	0	3
ENE	0	0	0	0	1	1	3	1	0	0	0	0	6
E	0	0	0	0	0	6	2	0	0	0	0	0	8
ESE	0	0	0	2	1	3	25	0	2	0	0	0	33
SE	0	0	0	0	0	6	40	19	13	1	0	0	79
SSE	0	0	0	1	6	7	12	11	6	5	9	2	59
S	0	0	2	2	1	5	5	0	5	3	1	0	24
SSW	0	0	0	0	0	5	1	1	3	2	0	0	12
SW	0	0	0	1	1	1	8	0	4	7	1	0	23
WSW	0	0	0	3	2	5	3	4	8	2	1	0	28
W	0	0	1	2	6	8	4	7	4	0	0	0	32
WNW	0	0	1	2	2	16	7	12	7	1	0	0	48
NW	0	0	0	4	6	12	7	1	2	1	0	0	33
MNW	0	0	0	4	5	9	7	0	0	0	0	0	25
TOTALS	0	0	5	28	37	95	132	58	54	22	12	2	445
NUMBER OF VALID HOURS					445	NUMBER OF CALMS					0		
NUMBER OF INVALID HOURS					0	TOTAL HOURS FOR THE PERIOD					445		



# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

January-March

Table 4A

SITE: SAN ONOFRE  
PERIOD OF RECORD 10010100-10033123  
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E

SLIGHTLY STABLE ( $-0.5 < DT/DZ \leq 1.5$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	7	6	13	3	0	0	0	0	0	29
NNE	0	0	2	13	12	18	17	0	0	0	0	0	62
NE	0	0	0	6	5	6	1	1	0	0	0	0	19
ENE	0	0	2	9	2	2	2	1	0	0	0	0	18
E	0	0	2	4	1	3	0	1	0	0	0	0	11
ESE	0	0	1	1	1	8	2	0	0	0	0	0	13
SE	0	0	1	1	2	4	2	0	0	0	0	0	10
SSE	0	0	1	2	2	1	1	1	0	0	0	0	8
S	0	0	0	1	1	1	0	0	0	0	0	0	3
SSW	0	0	1	3	2	0	0	0	0	0	0	0	6
SW	0	0	1	4	2	0	0	0	0	0	0	0	7
WSW	0	0	2	0	1	3	0	0	0	0	0	0	6
W	0	0	0	0	6	4	3	0	0	0	0	0	13
WNW	0	0	0	3	3	12	4	8	0	0	0	0	30
NW	0	0	0	3	2	5	1	0	0	0	0	0	11
MNW	0	1	0	2	5	7	3	0	0	0	0	0	18
TOTALS	0	1	13	59	53	87	39	12	0	0	0	0	264

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

264  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
264

PASQUILL F

MODERATELY STABLE ( $1.5 < DT/DZ < -4.0$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	1	4	7	4	1	0	0	0	0	0	17
NNE	0	1	1	13	40	42	23	0	0	0	0	0	120
NE	0	1	2	19	18	7	2	0	0	0	0	0	49
ENE	0	1	1	4	10	2	1	0	0	0	0	0	19
E	0	0	2	4	2	3	0	0	0	0	0	0	11
ESE	0	1	0	0	1	3	0	0	0	0	0	0	5
SE	0	0	0	3	1	1	0	0	0	0	0	0	5
SSE	0	0	0	1	2	1	1	0	0	0	0	0	5
S	0	0	1	1	2	0	1	0	0	0	0	0	5
SSW	0	0	2	1	2	1	0	0	0	0	0	0	6
SW	0	0	0	1	0	0	0	0	0	0	0	0	1
WSW	0	0	1	1	2	1	0	0	0	0	0	0	5
W	0	0	1	4	0	0	0	0	0	0	0	0	5
WNW	0	0	0	3	4	12	6	0	0	0	0	0	25
NW	0	0	1	1	4	5	0	0	0	0	0	0	11
MNW	0	0	0	0	3	4	2	0	0	0	0	0	9
TOTALS	0	4	13	60	98	86	37	0	0	0	0	0	298

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

298  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
298

## ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

January-March

Table 4A

SITE: SAN ONOFRE

PERIOD OF RECORD 10010100-10033123

WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL G

EXTREMELY STABLE (DT/DZ &gt; 4.0 °C/100 METERS)

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	0	3	3	9	6	0	0	0	0	0	21
NNE	0	0	0	4	19	183	206	3	0	0	0	0	415
NE	0	0	0	8	17	33	10	0	0	0	0	0	68
ENE	0	0	1	1	6	7	0	0	0	0	0	0	15
E	0	0	0	1	1	0	0	0	0	0	0	0	2
ESE	0	0	0	1	2	0	0	0	0	0	0	0	3
SE	0	0	0	1	2	1	2	0	0	0	0	0	6
SSE	0	0	1	2	0	2	0	0	0	0	0	0	5
S	0	0	0	0	1	2	1	0	0	0	0	0	4
SSW	0	0	0	1	0	1	1	0	0	0	0	0	3
SW	0	0	0	2	1	1	2	0	0	0	0	0	6
WSW	0	0	0	2	0	0	1	0	0	0	0	0	3
W	0	0	1	1	2	2	0	0	0	0	0	0	6
WNW	0	0	0	1	0	2	0	0	0	0	0	0	3
NW	0	0	0	0	0	1	2	0	0	0	0	0	3
MNW	0	0	0	2	1	1	0	0	0	0	0	0	4
TOTALS	0	0	3	30	55	245	231	3	0	0	0	0	567

  

NUMBER OF VALID HOURS	567	NUMBER OF CALMS	0
NUMBER OF INVALID HOURS	0	TOTAL HOURS FOR THE PERIOD	567

ALL STABILITY CLASSES, ALL DT/DZ

WIND SPEED (M/S) AT 10 METER LEVEL

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	2	20	21	31	13	1	0	0	0	0	88
NNE	0	1	3	30	73	251	250	4	0	0	0	0	612
NE	0	1	2	34	40	47	14	1	0	0	0	0	139
ENE	0	1	4	14	19	12	6	2	0	0	0	0	58
E	0	0	4	9	4	12	2	1	0	0	0	0	32
ESE	0	2	1	4	6	14	27	0	2	0	0	0	56
SE	0	0	1	6	5	12	46	19	13	2	0	0	104
SSE	0	0	3	7	11	16	25	24	8	6	10	2	112
S	0	0	3	8	11	20	31	4	7	4	1	0	89
SSW	0	0	3	8	14	23	20	2	3	3	0	0	76
SW	0	0	3	12	22	25	21	1	5	7	1	0	97
WSW	0	0	3	9	21	40	17	10	11	2	1	0	114
W	0	0	3	10	27	76	58	13	5	0	0	0	192
WNW	0	0	1	10	15	73	99	29	11	1	0	0	239
NW	0	0	1	9	13	33	29	5	4	1	0	0	95
MNW	0	1	0	8	14	22	12	0	0	0	0	0	57
TOTALS	0	6	37	198	316	707	670	116	69	26	13	2	2160

  

NUMBER OF VALID HOURS	2160	NUMBER OF CALMS	0
NUMBER OF INVALID HOURS	0	TOTAL HOURS FOR THE PERIOD	2160

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

April-June

Table 4A

SITE: SAN ONOFRE  
PERIOD OF RECORD 10040100-10063023  
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL A

EXTREMELY UNSTABLE ( $DT/DZ \leq -1.9^{\circ}\text{C}/100 \text{ METERS}$ )

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	1	1	0	0	0	0	0	0	0	2
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	1	0	1	0	0	0	0	2
E	0	0	0	0	0	0	0	1	0	0	0	0	1
ESE	0	0	0	1	1	1	0	0	0	0	0	0	3
SE	0	0	0	0	0	1	0	0	0	0	0	0	1
SSE	0	0	0	0	0	4	6	3	0	0	0	0	13
S	0	0	0	2	4	20	57	12	0	0	0	0	95
SSW	0	0	0	1	8	24	69	7	0	0	0	0	109
SW	0	0	0	3	6	48	67	2	0	0	0	0	126
WSW	0	0	0	0	12	89	85	1	0	0	0	0	187
W	0	0	0	1	14	44	108	6	3	0	0	0	176
WNW	0	0	0	0	5	31	65	16	5	0	0	0	122
NW	0	0	0	1	1	3	10	8	3	0	0	0	26
MNW	0	0	0	0	0	1	0	0	0	0	0	0	1
TOTALS	0	0	0	10	52	267	467	57	11	0	0	0	864

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

864  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
864

PASQUILL B

MODERATELY UNSTABLE ( $-1.9 < DT/DZ < -1.7^{\circ}\text{C}/100 \text{ METERS}$ )

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	1	1	0	0	0	0	0	0	2
NNE	0	0	0	0	2	1	0	0	0	0	0	0	3
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	1	0	0	0	0	0	0	0	1
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	1	0	0	0	0	0	0	0	1
SSE	0	0	0	0	0	0	10	3	0	0	0	0	13
S	0	0	0	0	1	4	16	4	0	0	0	0	25
SSW	0	0	0	1	3	10	16	6	0	0	0	0	36
SW	0	0	0	3	3	7	6	2	0	0	0	0	21
WSW	0	0	0	2	1	5	2	1	0	0	0	0	11
W	0	0	0	3	1	1	0	0	1	0	0	0	6
WNW	0	0	0	3	3	1	1	2	0	0	0	0	10
NW	0	0	0	3	5	6	5	3	0	0	0	0	22
MNW	0	0	0	1	2	0	0	0	0	0	0	0	3
TOTALS	0	0	0	16	24	36	56	21	1	0	0	0	154

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

154  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
154

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

April-June

Table 4A

SITE: SAN ONOFRE  
PERIOD OF RECORD 10040100-10063023  
WIND SPEED (M/S) AT 10 METER LEVEL

### PASQUILL C

SLIGHTLY UNSTABLE ( $-1.7 < DT/DZ \leq -1.5$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	2	1	1	0	0	0	0	0	0	4
NNE	0	0	0	0	5	4	0	0	0	0	0	0	9
NE	0	0	0	0	6	3	0	0	0	0	0	0	9
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	1	2	1	1	0	0	0	0	0	0	5
ESE	0	0	0	0	0	2	0	0	0	0	0	0	2
SE	0	0	0	1	0	1	2	1	0	0	0	0	5
SSE	0	0	0	1	1	13	23	9	1	0	0	0	48
S	0	0	1	1	6	18	23	5	0	0	0	0	54
SSW	0	0	0	1	2	9	5	1	0	0	0	0	18
SW	0	0	0	5	8	0	2	1	0	0	0	0	16
WSW	0	0	0	4	3	2	3	0	0	0	0	0	12
W	0	0	0	1	0	2	0	2	0	0	0	0	5
WNW	0	0	0	3	2	1	0	2	0	0	0	0	8
NW	0	0	0	3	4	6	4	3	0	0	0	0	20
MNW	0	0	0	2	2	3	0	0	0	0	0	0	7
TOTALS	0	0	2	26	41	66	62	24	1	0	0	0	222
NUMBER OF VALID HOURS					223	NUMBER OF CALMS					1		
NUMBER OF INVALID HOURS					0	TOTAL HOURS FOR THE PERIOD					223		

### PASQUILL D

NEUTRAL ( $-1.5 < DT/DZ \leq -0.5$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	1	6	7	4	0	0	0	0	0	0	18
NNE	1	0	0	6	6	8	2	0	0	0	0	0	23
NE	0	0	1	4	6	4	0	0	0	0	0	0	15
ENE	0	0	0	3	3	1	0	0	0	0	0	0	7
E	0	1	0	4	5	9	4	0	0	0	0	0	23
ESE	0	0	1	2	7	9	18	0	0	0	0	0	37
SE	0	0	1	3	10	29	62	18	0	0	0	0	123
SSE	0	0	1	4	10	21	38	8	0	2	0	0	84
S	1	0	0	5	8	14	10	2	1	3	0	0	44
SSW	0	0	1	3	11	10	4	0	0	0	0	0	29
SW	0	0	2	6	2	0	2	0	1	0	0	0	13
WSW	0	0	0	3	1	5	4	0	1	0	0	0	14
W	0	0	1	5	2	0	3	4	5	0	0	0	20
WNW	0	0	2	7	2	3	8	7	8	0	0	0	37
NW	0	0	0	7	1	1	6	4	4	0	0	0	23
MNW	0	0	1	3	4	7	4	0	0	0	0	0	19
TOTALS	2	1	12	71	85	125	165	43	20	5	0	0	529
NUMBER OF VALID HOURS					529	NUMBER OF CALMS					0		
NUMBER OF INVALID HOURS					0	TOTAL HOURS FOR THE PERIOD					529		

## ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

April-June

Table 4A

SITE: SAN ONOFRE  
 PERIOD OF RECORD 10040100-10063023  
 WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E

SLIGHTLY STABLE ( $-0.5 < DT/DZ \leq 1.5$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	1	6	2	1	0	0	0	0	0	10
NNE	0	0	0	7	4	20	3	0	0	0	0	0	34
NE	0	0	0	6	7	0	0	0	0	0	0	0	13
ENE	0	0	1	2	1	1	0	0	0	0	0	0	5
E	0	0	0	1	2	1	0	0	0	0	0	0	4
ESE	0	0	0	0	2	2	0	0	0	0	0	0	4
SE	0	0	0	2	1	0	1	0	0	0	0	0	4
SSE	0	0	0	0	0	0	2	0	0	0	0	0	2
S	0	0	0	3	0	0	0	0	0	0	0	0	3
SSW	0	0	0	3	0	2	0	0	0	0	0	0	5
SW	0	0	0	1	0	0	0	0	0	0	0	0	1
WSW	0	0	2	0	0	0	0	0	0	0	0	0	2
W	0	0	0	0	0	1	0	0	0	0	0	0	1
WNW	0	0	0	1	1	1	0	0	0	0	0	0	3
NW	0	0	0	3	1	0	1	1	0	0	0	0	6
MNW	0	0	0	2	1	1	3	0	0	0	0	0	7
TOTALS	0	0	3	32	26	31	11	1	0	0	0	0	104
NUMBER OF VALID HOURS						104	NUMBER OF CALMS					0	
NUMBER OF INVALID HOURS						0	TOTAL HOURS FOR THE PERIOD					104	

PASQUILL F

MODERATELY STABLE ( $1.5 < DT/DZ < -4.0$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	1	0	1	1	1	0	0	0	0	0	4
NNE	0	0	0	6	27	39	5	0	0	0	0	0	77
NE	0	1	1	7	8	4	0	0	0	0	0	0	21
ENE	3	1	1	3	2	3	0	0	0	0	0	0	13
E	0	0	0	1	1	1	0	0	0	0	0	0	3
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	1	0	2	0	0	0	0	0	0	0	3
S	0	0	0	0	0	0	0	0	0	0	0	0	0
SSW	0	0	1	0	0	0	0	0	0	0	0	0	1
SW	0	0	0	1	0	0	0	0	0	0	0	0	1
WSW	0	0	0	1	0	0	1	0	0	0	0	0	2
W	0	0	0	1	0	0	0	0	0	0	0	0	1
WNW	0	0	0	2	0	0	0	0	0	0	0	0	2
NW	0	0	0	0	1	1	0	0	0	0	0	0	2
MNW	0	0	0	0	1	0	0	0	0	0	0	0	1
TOTALS	3	2	5	22	43	49	7	0	0	0	0	0	131
NUMBER OF VALID HOURS						138	NUMBER OF CALMS					7	
NUMBER OF INVALID HOURS						0	TOTAL HOURS FOR THE PERIOD					138	

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

April-June

Table 4A

SITE: SAN ONOFRE

PERIOD OF RECORD 10040100-10063023

WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL G

EXTREMELY STABLE (DT/DZ > 4.0 °C/100 METERS)

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	0	0	0	0	1	0	0	0	0	0	1
NNE	0	0	0	0	10	84	50	0	0	0	0	0	144
NE	0	0	0	1	6	6	1	0	0	0	0	0	14
ENE	0	0	1	0	1	1	0	0	0	0	0	0	3
E	0	0	0	0	1	0	0	0	0	0	0	0	1
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	1	1	0	0	0	0	0	0	2
S	0	0	0	1	1	0	0	0	0	0	0	0	2
SSW	0	0	0	0	0	1	0	0	0	0	0	0	1
SW	0	0	0	0	0	0	0	0	0	0	0	0	0
WSW	0	0	0	1	0	0	0	0	0	0	0	0	1
W	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	1	0	0	0	0	0	0	0	0	1
NW	0	0	0	0	0	0	0	0	0	0	0	0	0
MNW	0	0	0	0	1	0	1	0	0	0	0	0	2
TOTALS	0	0	1	4	21	93	53	0	0	0	0	0	172

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

172  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
172

ALL STABILITY CLASSES, ALL DT/DZ

WIND SPEED (M/S) AT 10 METER LEVEL

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	2	10	17	9	3	0	0	0	0	0	41
NNE	1	0	0	19	54	156	60	0	0	0	0	0	290
NE	0	1	2	18	33	17	1	0	0	0	0	0	72
ENE	3	1	3	8	8	7	0	1	0	0	0	0	31
E	0	1	1	8	10	12	4	1	0	0	0	0	37
ESE	0	0	1	3	10	14	18	0	0	0	0	0	46
SE	0	0	1	6	12	31	65	19	0	0	0	0	134
SSE	0	0	2	5	14	39	79	23	1	2	0	0	165
S	1	0	1	12	20	56	106	23	1	3	0	0	223
SSW	0	0	2	9	24	56	94	14	0	0	0	0	199
SW	0	0	2	19	19	55	77	5	1	0	0	0	178
WSW	0	0	2	11	17	101	95	2	1	0	0	0	229
W	0	0	1	11	17	48	111	12	9	0	0	0	209
WNW	0	0	2	17	13	37	74	27	13	0	0	0	183
NW	0	0	0	17	13	17	26	19	7	0	0	0	99
MNW	0	0	1	8	11	12	8	0	0	0	0	0	40
TOTALS	5	3	23	181	292	667	821	146	33	5	0	0	2176

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

2184  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

8  
2184

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

July-September  
Table 4A

SITE: SAN ONOFRE  
PERIOD OF RECORD 10070100-10093023  
WIND SPEED (M/S) AT 10 METER LEVEL

### PASQUILL A

EXTREMELY UNSTABLE ( $DT/DZ \leq -1.9^{\circ}\text{C}/100 \text{ METERS}$ )

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	1	1	0	0	0	0	0	0	0	2
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	1	0	0	0	0	0	0	0	0	1
E	0	0	0	0	1	1	0	0	0	0	0	0	2
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	1	0	0	0	0	0	0	0	0	1
SSE	0	0	0	0	0	0	0	0	0	0	0	0	0
S	0	0	0	0	1	1	22	11	1	0	0	0	36
SSW	0	0	0	1	5	8	9	2	0	0	0	0	25
SW	0	0	0	1	13	44	32	1	0	0	0	0	91
WSW	0	0	0	2	15	61	48	0	0	0	0	0	126
W	0	0	0	0	17	116	93	0	0	0	0	0	226
WNW	0	0	0	0	7	46	126	9	0	0	0	0	188
NW	0	0	0	0	1	3	8	3	0	0	0	0	15
MNW	0	0	0	1	0	0	0	0	0	0	0	0	1
TOTALS	0	0	0	8	61	280	338	26	1	0	0	0	714

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

714  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
714

### PASQUILL B

MODERATELY UNSTABLE ( $-1.9 < DT/DZ < -1.7^{\circ}\text{C}/100 \text{ METERS}$ )

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	0	1	0	0	0	0	0	0	1
NNE	0	0	0	0	0	1	0	0	0	0	0	0	1
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	1	2	2	0	0	0	0	5
S	0	0	0	0	2	3	3	3	0	0	0	0	11
SSW	0	0	0	1	2	5	4	1	0	0	0	0	13
SW	0	0	0	2	1	10	8	0	0	0	0	0	21
WSW	0	0	0	1	1	2	2	0	0	0	0	0	6
W	0	0	0	0	3	0	0	0	0	0	0	0	3
WNW	0	0	0	0	5	5	2	0	0	0	0	0	12
NW	0	0	0	1	0	1	1	0	0	0	0	0	3
MNW	0	0	0	0	2	0	0	0	0	0	0	0	2
TOTALS	0	0	0	5	16	29	22	6	0	0	0	0	78

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

78  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
78

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

July-September

Table 4A

SITE: SAN ONOFRE

PERIOD OF RECORD 10070100-10093023

WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL C

SLIGHTLY UNSTABLE ( $-1.7 < DT/DZ \leq -1.5$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	1	1	0	0	0	0	0	0	2
NNE	0	0	0	1	1	1	0	0	0	0	0	0	3
NE	0	0	0	0	3	0	0	0	0	0	0	0	3
ENE	0	0	0	1	0	0	0	0	0	0	0	0	1
E	0	0	0	0	1	0	0	0	0	0	0	0	1
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	1	1	0	0	0	0	0	0	2
SSE	0	0	0	0	0	2	15	2	0	0	0	0	19
S	0	0	0	0	0	2	8	0	0	0	0	0	10
SSW	0	0	0	2	1	7	4	0	0	0	0	0	14
SW	0	0	0	1	0	3	7	0	0	0	0	0	11
WSW	0	0	0	1	1	7	4	0	0	0	0	0	13
W	0	0	0	2	3	5	1	0	0	0	0	0	11
WNW	0	0	0	1	2	6	0	0	0	0	0	0	9
NW	0	0	0	0	2	4	5	0	0	0	0	0	11
MNW	0	0	0	0	1	1	0	0	0	0	0	0	2
TOTALS	0	0	0	9	17	40	44	2	0	0	0	0	112

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

112  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
112

PASQUILL D

NEUTRAL ( $-1.5 < DT/DZ \leq -0.5$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	2	11	9	2	2	0	0	0	0	0	26
NNE	0	0	2	2	16	24	6	0	0	0	0	0	50
NE	0	0	1	8	3	7	0	0	0	0	0	0	19
ENE	0	0	0	1	3	0	0	0	0	0	0	0	4
E	0	0	0	1	1	2	0	0	0	0	0	0	4
ESE	0	0	2	3	3	6	5	0	0	0	0	0	19
SE	0	0	0	4	9	22	35	1	0	0	0	0	71
SSE	0	1	0	6	22	25	50	11	0	0	0	0	115
S	0	1	0	15	14	29	22	1	0	0	0	0	82
SSW	0	0	2	11	20	24	10	0	0	0	0	0	67
SW	0	0	2	13	14	10	4	0	0	0	0	0	43
WSW	0	1	4	6	6	1	0	0	0	0	0	0	18
W	0	0	1	11	10	16	19	0	0	0	0	0	57
WNW	0	0	2	10	7	13	10	0	0	0	0	0	42
NW	0	0	0	10	17	31	11	0	0	0	0	0	69
MNW	0	0	1	10	16	12	0	0	0	0	0	0	39
TOTALS	0	3	19	122	170	224	174	13	0	0	0	0	725

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

725  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
725



# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

July-September

Table 4A

SITE: SAN ONOFRE  
PERIOD OF RECORD 10070100-10093023  
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E

SLIGHTLY STABLE ( $-0.5 < DT/DZ \leq 1.5$  °C/100 METERS)

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	2	10	8	6	1	0	0	0	0	0	27
NNE	0	1	1	9	19	28	2	0	0	0	0	0	60
NE	0	0	1	6	3	1	0	0	0	0	0	0	11
ENE	0	0	2	2	4	0	0	0	0	0	0	0	8
E	0	2	1	8	1	0	0	0	0	0	0	0	12
ESE	0	1	3	3	7	2	1	0	0	0	0	0	17
SE	0	0	2	0	5	2	6	2	0	0	0	0	17
SSE	0	0	0	7	8	8	6	0	0	0	0	0	29
S	0	1	1	6	3	5	0	0	0	0	0	0	16
SSW	0	1	1	6	0	0	0	0	0	0	0	0	8
SW	1	1	3	1	3	0	0	0	0	0	0	0	9
WSW	0	1	4	2	2	1	0	0	0	0	0	0	10
W	0	1	6	6	6	1	0	0	0	0	0	0	20
WNW	0	0	2	6	6	10	8	0	0	0	0	0	32
NW	0	1	1	7	4	0	1	0	0	0	0	0	14
MNW	0	0	2	4	9	2	0	0	0	0	0	0	17
TOTALS	1	10	32	83	88	66	25	2	0	0	0	0	307

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

307  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
307

PASQUILL F

MODERATELY STABLE ( $1.5 < DT/DZ < -4.0$  °C/100 METERS)

WIND	.22	.51	.76	1.1	1.6	2.1	3.1	5.1	7.1	10.1	13.1	>18	TOTAL
DIR	.50	.75	1.0	1.5	2.0	3.0	5.0	7.0	10.0	13.0	18.0		
N	0	0	1	1	6	6	0	0	0	0	0	0	14
NNE	0	0	1	11	22	36	1	0	0	0	0	0	71
NE	0	0	0	2	4	0	0	0	0	0	0	0	6
ENE	0	0	1	5	2	1	0	0	0	0	0	0	9
E	0	0	0	0	1	1	0	0	0	0	0	0	2
ESE	0	0	0	1	1	0	0	0	0	0	0	0	2
SE	0	0	1	4	3	2	6	1	0	0	0	0	17
SSE	0	0	0	2	3	0	2	0	0	0	0	0	7
S	0	0	0	3	0	0	0	0	0	0	0	0	3
SSW	0	0	1	3	0	1	0	0	0	0	0	0	5
SW	0	0	1	3	1	0	0	0	0	0	0	0	5
WSW	0	0	1	3	0	1	0	0	0	0	0	0	5
W	0	0	0	1	0	1	0	0	0	0	0	0	2
WNW	0	0	2	1	1	0	2	0	0	0	0	0	6
NW	0	0	0	2	2	0	2	0	0	0	0	0	6
MNW	0	1	0	4	0	0	0	0	0	0	0	0	5
TOTALS	0	1	9	46	46	49	13	1	0	0	0	0	165

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

165  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
165

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

July-September  
Table 4A

SITE: SAN ONOFRE  
PERIOD OF RECORD 10070100-10093023  
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL G

EXTREMELY STABLE (DT/DZ > 4.0 °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	1	1	2	0	0	0	0	0	0	4
NNE	0	1	1	1	8	36	20	0	0	0	0	0	67
NE	0	0	0	1	2	3	0	0	0	0	0	0	6
ENE	0	0	0	1	1	1	0	0	0	0	0	0	3
E	0	0	0	1	0	1	0	0	0	0	0	0	2
ESE	0	0	0	0	0	0	1	0	0	0	0	0	1
SE	0	0	0	1	0	1	0	2	0	0	0	0	4
SSE	0	0	0	1	1	2	0	0	0	0	0	0	4
S	0	0	0	0	1	0	0	0	0	0	0	0	1
SSW	0	0	0	1	0	0	1	0	0	0	0	0	2
SW	0	0	0	0	2	0	0	0	0	0	0	0	2
WSW	0	0	0	0	0	1	0	0	0	0	0	0	1
W	0	0	0	0	1	1	0	0	0	0	0	0	2
WNW	0	0	0	0	1	5	0	0	0	0	0	0	6
NW	0	0	0	0	0	1	0	0	0	0	0	0	1
MNW	0	0	0	0	0	1	0	0	0	0	0	0	1
TOTALS	0	1	1	8	18	55	22	2	0	0	0	0	107

NUMBER OF VALID HOURS 107  
 NUMBER OF INVALID HOURS 0  
 NUMBER OF CALMS 0  
 TOTAL HOURS FOR THE PERIOD 107

ALL STABILITY CLASSES, ALL DT/DZ

WIND SPEED (M/S) AT 10 METER LEVEL

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	5	24	26	18	3	0	0	0	0	0	76
NNE	0	2	5	24	66	126	29	0	0	0	0	0	252
NE	0	0	2	17	15	11	0	0	0	0	0	0	45
ENE	0	0	3	11	10	2	0	0	0	0	0	0	26
E	0	2	1	10	5	5	0	0	0	0	0	0	23
ESE	0	1	5	7	11	8	7	0	0	0	0	0	39
SE	0	0	3	10	18	28	47	6	0	0	0	0	112
SSE	0	1	0	16	34	38	75	15	0	0	0	0	179
S	0	2	1	24	21	40	55	15	1	0	0	0	159
SSW	0	1	4	25	28	45	28	3	0	0	0	0	134
SW	1	1	6	21	34	67	51	1	0	0	0	0	182
WSW	0	2	9	15	25	74	54	0	0	0	0	0	179
W	0	1	7	20	40	140	113	0	0	0	0	0	321
WNW	0	0	6	18	29	85	148	9	0	0	0	0	295
NW	0	1	1	20	26	40	28	3	0	0	0	0	119
MNW	0	1	3	19	28	16	0	0	0	0	0	0	67
TOTALS	1	15	61	281	416	743	638	52	1	0	0	0	2208

NUMBER OF VALID HOURS 2208  
 NUMBER OF INVALID HOURS 0  
 NUMBER OF CALMS 0  
 TOTAL HOURS FOR THE PERIOD 2208

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

October-December

Table 4A

SITE: SAN ONOFRE  
PERIOD OF RECORD 10100100-10123123  
WIND SPEED (M/S) AT 10 METER LEVEL

### PASQUILL A

EXTREMELY UNSTABLE ( $DT/DZ \leq -1.9^{\circ}\text{C}/100 \text{ METERS}$ )

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	0	0	0	1	0	0	0	0	1
NNE	0	0	0	0	2	1	0	0	0	0	0	0	3
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	1	5	6	2	0	0	0	0	14
S	0	0	0	0	1	13	19	5	0	0	0	0	38
SSW	0	0	0	1	3	9	2	1	0	0	0	0	16
SW	0	0	0	2	4	12	7	0	0	0	0	0	25
WSW	0	0	0	1	12	27	16	0	0	0	0	0	56
W	0	0	0	0	13	49	39	1	1	0	0	0	103
WNW	0	0	0	0	3	21	45	11	0	0	0	0	80
NW	0	0	0	0	0	2	3	2	0	0	0	0	7
MNW	0	0	0	0	0	1	0	0	0	0	0	0	1
TOTALS	0	0	0	4	39	140	137	23	1	0	0	0	344

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

344  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
344

### PASQUILL B

MODERATELY UNSTABLE ( $-1.9 < DT/DZ < -1.7^{\circ}\text{C}/100 \text{ METERS}$ )

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	1	0	0	0	0	0	1
NE	0	0	0	0	0	0	1	0	0	0	0	0	1
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	2	0	0	0	0	0	2
S	0	0	0	0	1	3	5	0	0	0	0	0	9
SSW	0	0	0	0	1	2	3	1	0	0	0	0	7
SW	0	0	0	0	0	1	1	0	0	0	0	0	2
WSW	0	0	0	0	3	1	2	0	0	0	0	0	6
W	0	0	0	3	2	0	1	0	0	0	0	0	6
WNW	0	0	0	0	1	2	0	0	0	0	0	0	3
NW	0	0	0	0	0	1	1	0	0	0	0	0	2
MNW	0	0	0	0	0	0	1	0	0	0	0	0	1
TOTALS	0	0	0	3	8	10	18	1	0	0	0	0	40

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

40  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
40

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

October-December

Table 4A

SITE: SAN ONOFRE  
PERIOD OF RECORD 10100100-10123123  
WIND SPEED (M/S) AT 10 METER LEVEL

### PASQUILL C

SLIGHTLY UNSTABLE ( $-1.7 < DT/DZ \leq -1.5$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	0	1	0	0	0	0	0	0	0	1
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	1	0	0	0	0	0	1
SE	0	0	0	0	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	1	3	4	0	0	0	0	8
S	0	0	0	0	0	1	2	1	0	0	0	0	4
SSW	0	0	0	0	2	1	2	1	0	0	0	0	6
SW	0	0	0	2	0	0	0	0	0	0	0	0	2
WSW	0	0	0	0	3	1	1	0	0	0	0	0	5
W	0	0	0	0	4	2	0	0	0	0	0	0	6
WNW	0	0	0	0	2	4	1	0	0	0	0	0	7
NW	0	0	0	0	0	3	3	1	0	0	0	0	7
MNW	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	0	0	0	2	12	13	13	7	0	0	0	0	47

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

47  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
47

### PASQUILL D

NEUTRAL ( $-1.5 < DT/DZ \leq -0.5$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	1	5	3	6	0	0	0	0	0	0	15
NNE	0	0	1	8	6	4	3	1	0	0	0	0	23
NE	0	0	0	1	2	3	0	0	0	0	0	0	6
ENE	0	0	0	2	2	0	1	0	0	0	0	0	5
E	0	0	0	1	0	1	1	0	0	0	0	0	3
ESE	0	0	0	7	3	4	8	4	0	0	0	0	26
SE	0	0	0	1	2	7	30	37	15	1	0	0	93
SSE	0	0	0	3	10	19	21	14	11	9	7	1	95
S	0	0	0	2	13	18	8	10	6	3	0	0	60
SSW	0	0	0	9	15	10	14	5	8	0	0	0	61
SW	0	1	2	8	13	4	9	3	1	1	0	0	42
WSW	0	0	0	7	4	12	23	1	0	2	0	0	49
W	0	0	0	5	14	18	11	2	4	1	0	0	55
WNW	0	0	0	10	7	10	9	6	2	0	0	0	44
NW	0	0	1	1	8	11	10	2	1	0	0	0	34
MNW	0	0	1	3	4	7	1	1	0	0	0	0	17
TOTALS	0	1	6	73	106	134	149	86	48	17	7	1	628

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

628  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
628

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

October-December  
Table 4A

SITE: SAN ONOFRE  
PERIOD OF RECORD 10100100-10123123  
WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL E

SLIGHTLY STABLE ( $-0.5 < DT/DZ \leq 1.5$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	10	7	7	2	0	0	0	0	0	26
NNE	0	0	2	17	22	10	10	3	0	0	0	0	64
NE	0	0	3	2	5	2	3	1	0	0	0	0	16
ENE	0	0	3	5	2	3	1	0	0	0	0	0	14
E	0	0	0	3	6	4	2	0	0	0	0	0	15
ESE	0	1	0	5	5	5	6	0	0	0	0	0	22
SE	0	0	1	4	6	12	16	1	0	0	0	0	40
SSE	0	1	1	4	3	9	3	2	3	2	0	0	28
S	0	1	1	5	7	4	2	0	1	3	3	0	27
SSW	0	0	2	2	2	1	0	1	0	0	0	0	8
SW	0	0	1	5	2	3	0	0	1	0	0	0	12
WSW	0	0	0	3	1	2	1	2	0	0	0	0	9
W	0	0	0	6	1	3	2	2	0	0	0	0	14
WNW	0	0	2	4	5	10	9	2	3	0	0	0	35
NW	0	0	0	3	3	7	5	2	2	0	0	0	22
MNW	0	0	0	2	6	9	6	1	0	0	0	0	24
TOTALS	0	3	16	80	83	91	68	17	10	5	3	0	376

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

376  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
376

PASQUILL F

MODERATELY STABLE ( $1.5 < DT/DZ < -4.0$  °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	6	7	8	7	0	0	0	0	0	28
NNE	0	0	0	9	36	46	14	0	0	0	0	0	105
NE	0	0	1	8	17	5	0	0	0	0	0	0	31
ENE	0	0	0	6	3	4	1	0	0	0	0	0	14
E	0	0	0	2	2	1	0	0	0	0	0	0	5
ESE	0	0	0	3	3	1	0	0	0	0	0	0	7
SE	0	0	0	0	1	1	2	0	0	0	0	0	4
SSE	0	0	0	1	1	3	0	0	0	0	0	0	5
S	0	0	0	0	3	1	1	0	0	0	0	0	5
SSW	0	0	1	6	0	0	0	0	0	0	0	0	7
SW	0	0	0	2	1	0	0	0	0	0	0	0	3
WSW	0	0	0	0	1	0	0	0	0	0	0	0	1
W	0	0	0	1	3	4	1	0	0	0	0	0	9
WNW	0	1	2	3	4	4	2	0	0	0	0	0	16
NW	0	0	0	5	2	2	2	0	0	0	0	0	11
MNW	0	0	0	1	1	3	2	0	0	0	0	0	7
TOTALS	0	1	4	53	85	83	32	0	0	0	0	0	258

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

258  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
258

# ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT (2010)

## METEOROLOGY

October-December

Table 4A

SITE: SAN ONOFRE

PERIOD OF RECORD 10100100-10123123

WIND SPEED (M/S) AT 10 METER LEVEL

PASQUILL G

EXTREMELY STABLE (DT/DZ > 4.0 °C/100 METERS)

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	0	1	1	6	11	0	0	0	0	0	19
NNE	0	0	0	2	26	153	176	7	0	0	0	0	364
NE	0	0	1	7	9	13	6	0	0	0	0	0	36
ENE	0	0	0	3	6	6	0	0	0	0	0	0	15
E	0	0	0	6	4	4	0	0	0	0	0	0	14
ESE	0	0	0	0	2	1	1	0	0	0	0	0	4
SE	0	0	1	2	1	0	2	1	0	0	0	0	7
SSE	0	0	0	0	0	1	1	0	0	0	0	0	2
S	0	0	0	3	2	0	1	0	0	0	0	0	6
SSW	0	0	1	2	0	1	0	0	0	0	0	0	4
SW	0	0	1	2	2	1	0	0	0	0	0	0	6
WSW	0	0	0	2	2	0	2	0	0	0	0	0	6
W	0	0	1	4	2	2	0	0	0	0	0	0	9
WNW	0	1	0	0	4	1	1	0	0	0	0	0	7
NW	0	0	1	1	2	5	3	0	0	0	0	0	12
MNW	0	0	1	0	1	2	0	0	0	0	0	0	4
TOTALS	0	1	7	35	64	196	204	8	0	0	0	0	515

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

515  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
515

ALL STABILITY CLASSES, ALL DT/DZ

WIND SPEED (M/S) AT 10 METER LEVEL

WIND DIR	.22 .50	.51 .75	.76 1.0	1.1 1.5	1.6 2.0	2.1 3.0	3.1 5.0	5.1 7.0	7.1 10.0	10.1 13.0	13.1 18.0	>18	TOTAL
N	0	0	1	22	19	27	20	1	0	0	0	0	90
NNE	0	0	3	36	92	214	204	11	0	0	0	0	560
NE	0	0	5	18	33	23	10	1	0	0	0	0	90
ENE	0	0	3	16	13	13	3	0	0	0	0	0	48
E	0	0	0	12	12	10	3	0	0	0	0	0	37
ESE	0	1	0	15	13	11	16	4	0	0	0	0	60
SE	0	0	2	7	10	20	50	39	15	1	0	0	144
SSE	0	1	1	8	15	38	36	22	14	11	7	1	154
S	0	1	1	10	27	40	38	16	7	6	3	0	149
SSW	0	0	4	20	23	24	21	9	8	0	0	0	109
SW	0	1	4	21	22	21	17	3	2	1	0	0	92
WSW	0	0	0	13	26	43	45	3	0	2	0	0	132
W	0	0	1	19	39	78	54	5	5	1	0	0	202
WNW	0	2	4	17	26	52	67	19	5	0	0	0	192
NW	0	0	2	10	15	31	27	7	3	0	0	0	95
MNW	0	0	2	6	12	22	10	2	0	0	0	0	54
TOTALS	0	6	33	250	397	667	621	142	59	22	10	1	2208

NUMBER OF VALID HOURS  
NUMBER OF INVALID HOURS

2208  
0

NUMBER OF CALMS  
TOTAL HOURS FOR THE PERIOD

0  
2208